GADS Open Source

Analysis & Reporting

GADS Open Source Project

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Contents

Analysis & Reporting

Introduction

GADS Open Source assumes the user has a basic knowledge of the NERC GADS and, as appropriate, of the additional data reporting requirements and calculated indices of the various ISOs that also require GADS data to be reported.

It is helpful if the user is familiar with the NERC GADS DRI Appendix G – Reporting Outages to the Generating Availability Data System (GADS) – Examples and Recommended Methods.

Two of the data types reported in GADS are used in Analysis & Reporting: event and performance data. The design data is not used directly by this software.

Event data are reported in the Event Report (07) format and performance data in the Performance Report (05) format. Each of these formats is described in detail in Sections III and IV of the NERC GADS DRI.

Generally, references to "GADS" refer to the definitions, terms, and requirements provided in the NERC GADS DRI, since all the ISOs have adopted the NERC GADS DRI as part of their reporting requirements.

However, be aware that in some cases there are specific differences related to the way events and performance data are reported. For example, events resulting from equipment failures or other causes "external" to the generating unit, can be reported significantly different between NERC and the various ISOs (e.g., U1 vs. RS). Procedures for determining performance data such as Maximum Capacities can be different between the two organizations, as well**.** Such differences can have a profound effect on calculated factors and rates.

The GADS Open Source Data Entry software will allow you to enter data following either the NERC or ISO standards, but it is your responsibility to determine which way to report the GADS data for your generating unit considering all the factors governing your reporting requirements.

Because of these differences you must give careful consideration to the options in the various GADS Open Source administrator and setup consoles, which allow you to determine how the software performs the calculations. The defaults are generally geared toward the NERC GADS DRI methodologies. You can customize some of these default settings to allow the use of formulas and equations defined by the various ISOs. We will be happy to discuss these issues with you at any time.

Submitting GADS data to NERC is currently voluntary. Submitting GADS data to the various independent system operators, such as ISO-NE, NYISO, and PJM is a part of your company's contractual obligation in return for connecting your generating units with their transmission systems.

Whether they submit GADS data to NERC and the ISOs or not, most companies find the performance and reliability information created from the GADS Open Source Analysis & Reporting software is an invaluable source to aid in achieving the best performance from each generating unit, at the lowest possible cost.

Even if they do not submit GADS data externally, most generating companies collect GADS data on each generating unit because of the tremendous value it provides to plant managers, engineers, and operating and maintenance personnel when combined with the analysis capabilities of the GADS Open Source Analysis & Reporting software.

The GADS Open Source Data Entry software allows you to collect the GADS Performance and Event data and to submit that data, as required, to NERC, the various ISOs such as the ISO of New England, New York ISO, Midwest ISO, and PJM, and any other agency or organization that collects the standard NERC GADS.

For the purposes of GADS data reporting, the term "unit" is defined by NERC GADS as follows:

- **Nuclear and fossil (steam) units –** those units consisting of a single reactor or boiler and a single turbine generator. In cases where multiple boilers and/or multiple turbine generators are headered together, the entire ensemble is considered a single unit and reported using the "Miscellaneous Unit" design data forms found in Appendix E, Pages E-117 to E-122 of the NERC DRI.
- **Hydro, pumped storage, gas turbine, jet engine, and diesel units –** those units consisting of the unique prime mover and a single generator. In cases where multiple combinations of turbines/engines and generators exist, either physically or because of operating philosophy, the entire ensemble may be considered as a single unit (i.e., a "block") or reported as individual units. Your specific reporting criteria should be noted on the NERC design data forms.
- **Combined cycle units (or blocks) –** By definition, a combined cycle is a process for generating energy (either electricity or steam) created by the combination of a Rankine Cycle (use heat to boil water to make steam to turn a steam turbine) with a Brayton Cycle (expand hot gas to turn a gas turbine). The combined cycle consisting of one or more gas turbines/jet engines and one or more heat recovery boilers. The steam from the heat recovery boiler is sent to a steam turbine for generating electricity. Each gas turbine/jet engine and each steam turbine is a "unit." The entire ensemble is considered a "BLOCK." Units where the gas turbines/jet engines can generate independent of the heat recovery boilers and steam turbine are also combined cycle blocks. Report design data using the "Combined Cycle Block" design data forms found in Appendix E, Pages E-123 to E-XXX of the NERC DRI.

- **Cogeneration units –** those units consisting of one or more gas turbines/jet engines and one or more heat recovery boilers. Cogeneration is similar to the combined cycle block except part of the steam from the heat recovery boiler is used for other purposes (process steam); not the generating electricity. The entire ensemble is considered a single block. Report design data using the "Combined Cycle Block" design data forms found in Appendix E, Pages E-123 to E-XXX of the NERC DRI.
- **Fluidized bed combustion units –** those units consist of one or more bubbling, circulating, or pressurized bed boilers or steam turbines. Consider the entire group as a single unit.

Reporting data to NERC GADS begins when one of the following conditions is met:

1. "The unit first enters the active state. This is termed the "service date" and occurs when the unit is first declared available for the dispatch of power at some level of its capability
2. "The unit first operates at 50% of its generator nameplate megawatt capability. For purposes of determining reporting requirements, the generator nameplate capability can be calculated by multiplying the MVA (megavoltamperes) by the rated power factor found on the nameplate affixed to the generator (nameplates in the case of multiple generator units)." [1]

Reporting event and performance data prior to either of the dates listed above is optional.

Data reporting requirements for the various ISOs are determined by each individual ISO. Check with an ISO representative to determine their initial reporting requirements.

Figure II-1 in the NERC DRI indicates the type of data each company should report for its units depending on the type and size of those units. Detailed data reporting for larger units is suggested and is indicated by the term "required." The term "optional" implies that each company must determine whether it can reasonably provide the detailed data on smaller units.

We encourage generating organizations to report all data elements currently collected for their units and any additional information they can reasonably provide.

Quick Start

After you have successfully created your generating units' GADS data, there are three steps to go through each month to initiate the full GADS Open Source Analysis & Reporting processing.

Very Important Note

Step 3 – Generate Reports can be run at any time and as often as needed after the first two steps are complete.

The following steps assume that the **Unit Setup Console** input has been completed, all of the generating units have been properly created, and the authorizations have been established in the **Admin Console,** as required.

1. Snapshot the data from the GADS Open Source Data Entry tables into the GADS Open Source Analysis & Reporting tables.

[1] Source: NERC GADS DRI

The snapshot process (Load Data | Load from Data Entry) transfers only the event and performance records that have been changed or added since the last snapshot was executed, eliminating the need to transfer all historical data between the two sets of tables. This transfer is done on the database server; the data is not transmitted over the network to or from the machine invoking the snapshot.

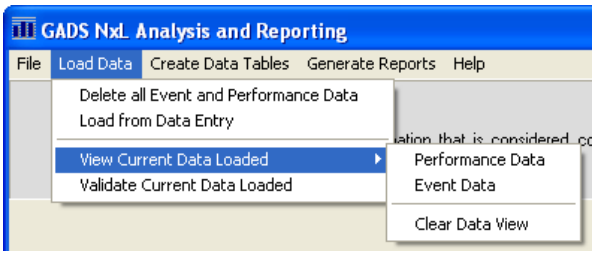

Figure 1. Load Data Menu

2. **Perform Calculations.**

   Calculations (**Create Data Tables** | **Perform Calculations**) are performed only for the units and years with changed or new performance and/or event data.

   For example, it is 2005. You are entering and revising GADS event and performance records in GADS Open Source Data Entry for all the units in your fleet. However, this month you also need to update a performance or event record from 2002 for Dallas Unit No. 1.

   In this example, when you Perform Calculations, the software calculates 2004 for all units (in most cases) and 2002 for Dallas Unit No. 1. By incorporating smart processing (Smart Proc™) into the calculation engine, the historical years and units that are not revised are not re-calculated; this is a tremendous timesaver.

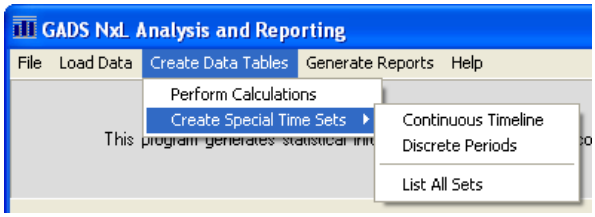

Figure 2. Create Data Tables Menu

3. **Generate Reports.**

   The software includes a number of standard reports grouping industry-standard performance measures and data in a logical historical fashion.

   After selecting a report group, such as **Individual Events**, you can set the various report options and selection criteria on the forms and screens that follow.

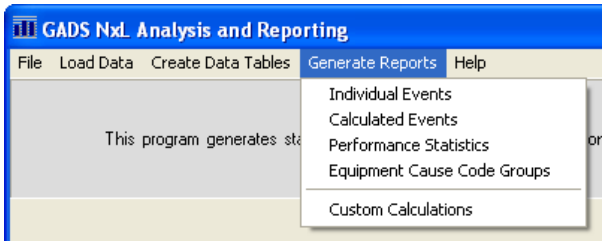

Figure 3. Generate Reports Menu

Main Menu

The "**Main** menu" is not actually a menu, but refers here to the top portion of the screen.

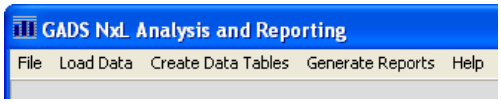

Figure 4. Analysis & Reporting Main Menu

Because of client concerns related to access security, some **Main** menu items are available only on the Windows UI and not on the Web UI, such as:

- Delete all Event and Performance Data
- Load from all Data Entry

Selections on the **Main** menu are made using your mouse pointer and "left-clicking" to run the desired function.

Before using it the first time…

The GADS Open Source software requires initialization before the first use of the software, by defining at least one or more of the generating units using the **Unit Setup Console**.

The installation includes an online Help file that you can access at any time by clicking **Help** on the **Main** menu.

When you install the application for the first time and no data is loaded, all historical data will be calculated; however, subsequent calculations will calculate only changed and/or new performance and event data for the applicable year and unit.

File

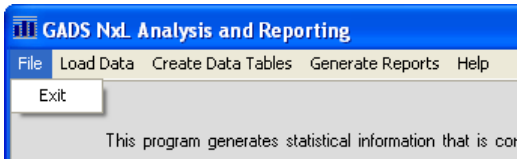

Figure 5. File | Exit Command

Very Important Note

Exit the application by selecting **File** | **Exit** (recommended) or by clicking **Close** (X) in the upper right corner of the Windows UI.

It is recommended that you close the application in the Windows UI before shutting down your computer; however, the same concerns do not apply to the Web UI.

Load Data

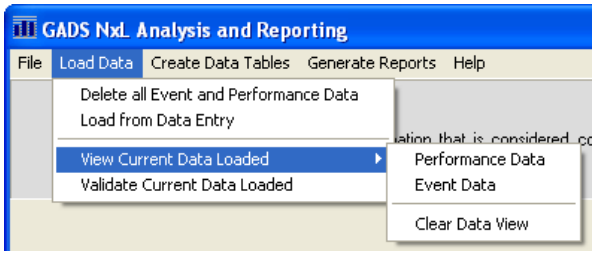

Figure 6. Load Data Menu

Delete all Event and Performance Data

Very Important Note

This command allows you to reset all Analysis & Reporting tables that are mirror-images of the GADS Open Source Data Entry event and performance data tables. This essentially forces the software to snapshot all of the data from the GADS Open Source Data Entry data tables and to recalculate all the historical data. This is useful if you need to "start over" for any reason.

When you click **Delete all Event and Performance Data**, the following dialog box appears asking if you wish to continue.

If you do not wish to delete all event and performance data, click **No**.

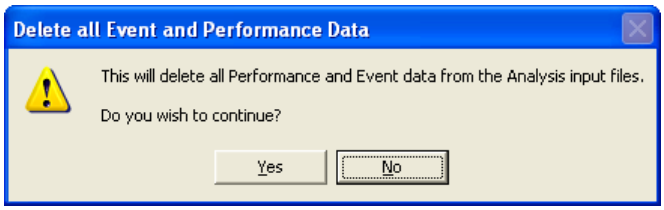

Figure 7. Delete Data Warning

If you click **Yes**, the GADS data will be deleted from the Analysis & Reporting tables and will have to be reloaded for the program to have data to use in the calculation process. This option is useful when it is necessary to start over; for example, when it appears that the data in the Analysis & Reporting tables has been corrupted.

Load from Data Entry

When you install the application for the first time and no data is loaded, all historical data will be loaded; however, all subsequent loading will copy only changed and/or new performance and event data for the applicable year and unit.

Load from Data Entry snapshots the data from the GADS Open Source Data Entry tables into the GADS Open Source Analysis & Reporting tables.

The snapshot process (**Load Data** | **Load from Data Entry**) transfers only the GADS event and performance records that have been changed or added since the last snapshot was executed, eliminating the need to transfer all historical data between the two sets of tables. This transfer is done on the database server; the data is not transmitted over the network to or from the machine invoking the snapshot.

When you click **Load from Data Entry**, the following dialog box appears asking if you wish to continue.

If you do not wish to load the event and performance data, click **No**.

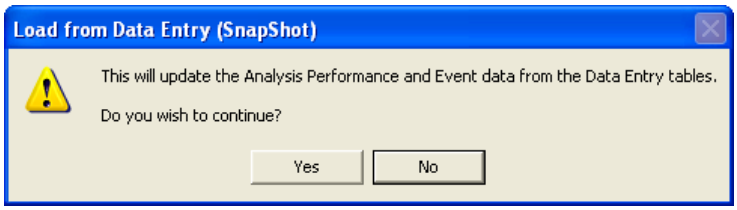

Figure 8. Load Data from Data Entry Dialog Box

If you click **Yes**, the screen in Figure 9 appears, allowing you to select which units to include in the loading. If you select **No**, the snapshot process is cancelled and you are returned to the main screen.

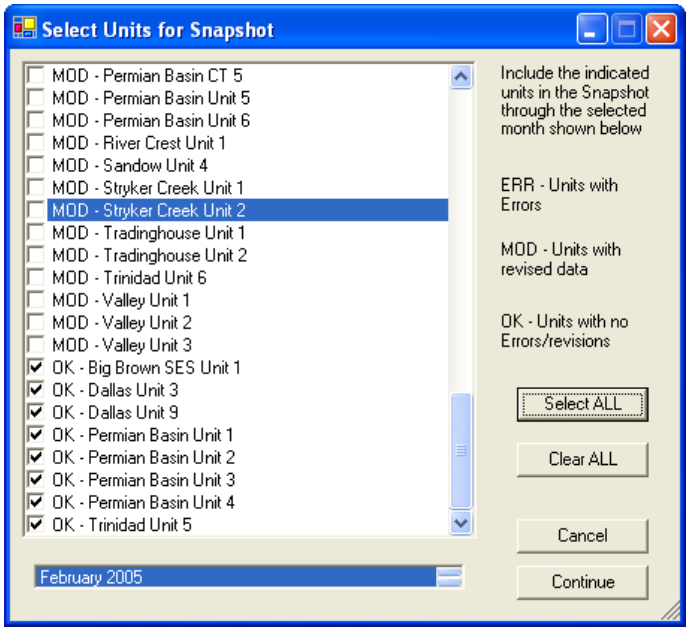

Figure 9. Unit Selection Dialog Box

All units determined by the GADS Open Source Data Entry software to be OK and error-free are automatically checked. However, there may be a need to process units that have revised data that has not yet had final validation run (MOD) or units that have errors (ERR). While units with MOD and ERR status can be processed, it is up to the user to determine whether the calculations can be successfully run or whether the results will be meaningful.

Checked units' data will be loaded into Analysis & Reporting.

You can also set a "cutoff" date for loading as well. For example, it is September 7th and you are getting ready to calculate through August, since everyone's data is now in, but several of the plant sites have started to enter September event data already. By setting the month/year as shown in Figure 9, only event and performance records up through and including August 2004 will be included in the snapshot, so potentially invalid data will be screened out.

When you have selected the units and the month/year, click **Continue,** or click **Cancel** to cancel the snapshot and return to the main screen.

The bottom left panel shows the last date/time when the data was snapshot from the Data Entry tables (**Data Last Loaded…**).

View Current Data Loaded – Performance Data

When you select the **View Current Data Loaded – Performance Data** command, the software displays a summary of the current performance data loaded into Analysis & Reporting, as shown in Figure 10.

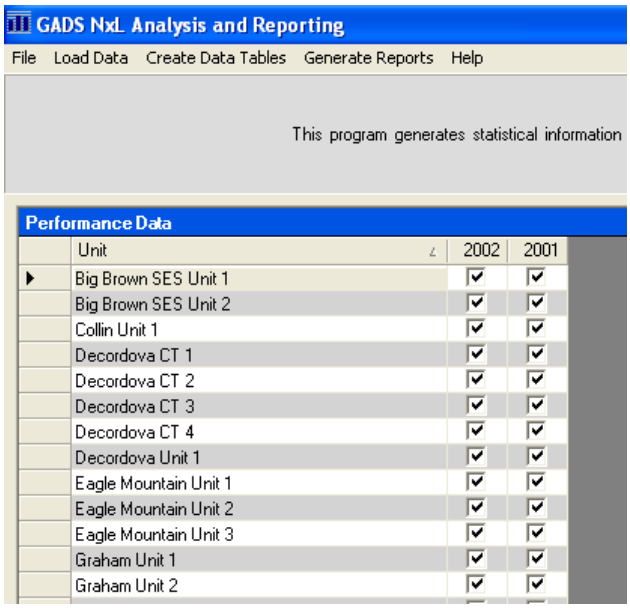

Figure 10. View Current Performance Data

This display allows you to easily determine which years are available for reporting for each unit in the database tables.

View Current Data Loaded – Event Data

When you select the **View Current Data Loaded – Event Data** command, the software displays a summary of the current event data loaded into Analysis & Reporting, as shown in Figure 11.

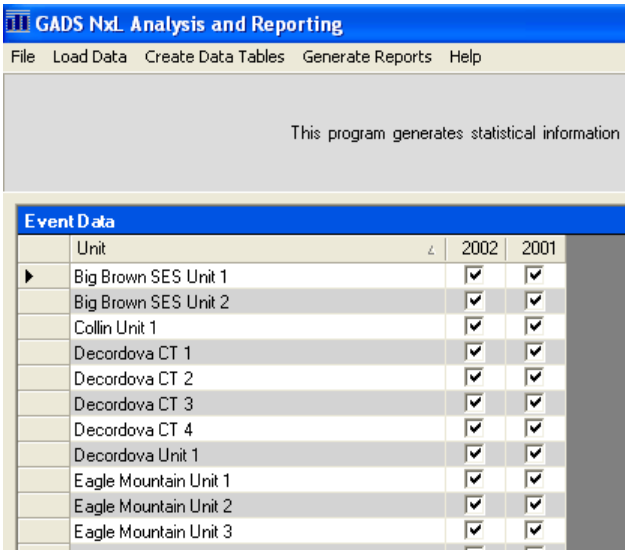

Figure 11. View Current Event Data

This display allows you to easily determine which years are available for reporting for each unit in the database tables.

View Current Data Loaded – Clear Data View

The **View Current Data Loaded – Clear Data View** command restores the main screen display, removing the Performance or Event summary.

Validate Current Data Loaded

The **Validate Current Data Loaded** command is reserved for future use. It is shown in the production version to promote user suggestions and feedback. The menu item is intended for situations where the user populates the database tables from outside the GADS Open Source software, using other applications such as PI Historian.

The normal assumption is that the user's application will validate the data before loading it into the Data Entry-equivalent tables. However, if such data needed validation prior to being calculated in Analysis & Reporting, this command would run the data validation objects.

Create Data Tables

Perform Calculations

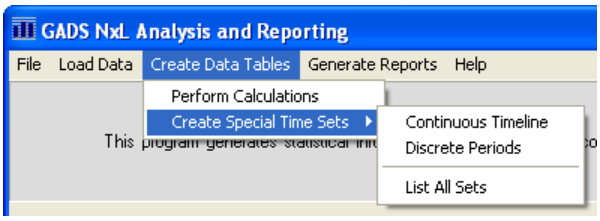

Figure 12. Create Special Time Sets

The **Perform Calculations** command uses the data that has just been loaded (**Load Data** | **Load from Data Entry**) to calculate the statistics with the new/revised data or to re-calculate the groups.

When you click **Perform Calculations**, you will see the following dialog box asking you if you wish to continue:

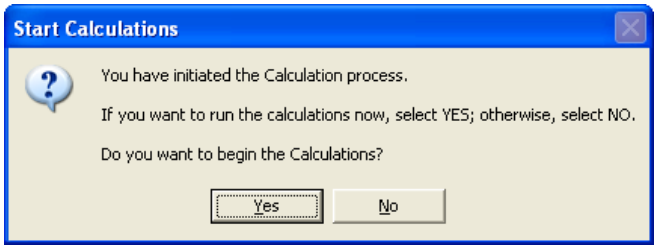

Figure 13. Start Calculations Warning

If you do not want to begin the Calculations, click **No**.

If you click **Yes**, the calculation process begins and the software will display the calculation progress on the main screen.

Remember that, as the software is calculating, anyone running reports may get a mixture of old and new statistics; old statistics for the units and/or groups that have not yet been processed and new statistics for the units and/or groups that have.

During the calculation process the progress bar will go from left to right several times as it processes the units first, and then the groups.

As it is processing and calculating the data, the indicator displayed in the lower right corner of the screen is **green**.

When the software is connecting to the database server and uploading the calculated data to the database tables, the indicator displayed in the lower right corner of the screen is **red**.

The lower right panel at the bottom of the main screen also displays the processing progress by showing the unit and/or group currently being processed.

Once it starts, we do not recommend stopping the processing by closing the main screen or shutting down your machine. Other than the one-time processing of all historical data for all units, the normal month-to-month processing should only calculate the current year's data for all units.

Very Important Note

If the unit data has not changed, but you have changed the groups to which units are assigned, the calculations can be re-run at any time, since only the groups will be recalculated. This process is very fast, since most of the calculation time is spent calculating the unit event and performance data, not in rolling the unit data into the group statistics. The group statistics are recalculated for all groups for all periods and granularities whenever the calculations are run.

When the calculations are complete, the center portion of the panel at the bottom of the main screen will show the date and time that the calculations were last performed (Calculations Last Performed on…).

Create Special Time Sets

Create Special Time Sets allows you to break the time period of interest into any subperiods of interest. There are two ways of segmenting the total time frame so that you can have the maximum flexibility in defining the subperiods:

- **Continuous Timeline** – breaks the total time period into contiguous (back-to-back without any gaps) subperiods (e.g., seasons of the year). There is no limit to the number or "fineness" of the granularity of each subperiod (the smallest subperiod that can be defined is one minute).
- **Discrete Periods** – breaks the total time period into discrete subperiod blocks that can (and generally do) have gaps between the subperiods (e.g., peak periods of the day, month, or year).

Continuous Timeline

The continuous timeline is broken into various back-to-back segments of time. The length of each time segment can be the same as, or different from, the other time segments. All time segments are calculated.

Event data prior to the first date/time entered will not be included in the results tables; therefore, you must enter a timeline beginning date/time as the first date/time in the list.

The continuous timeline is useful in a number of ways. For example, suppose you want to compare the summer peaking season, the fall overhaul season, the winter peaking season, and the spring overhaul season reliability for the last 5 years. The break points define the boundary date/time between each season. The first break point entered will be the date/time beginning the first season of interest.

The date/time values entered for this example do not have to match the normal seasons and do not have to break at traditional boundaries, such as the end of the month or at midnight.

You can have an unlimited number of pre-defined period sets. These sets are stored in a table in the database. Each unit can have its own continuous timeline period set identified in the **Unit Setup Console**.

When the calculations are run, each unit will have statistics calculated for each defined subperiod.

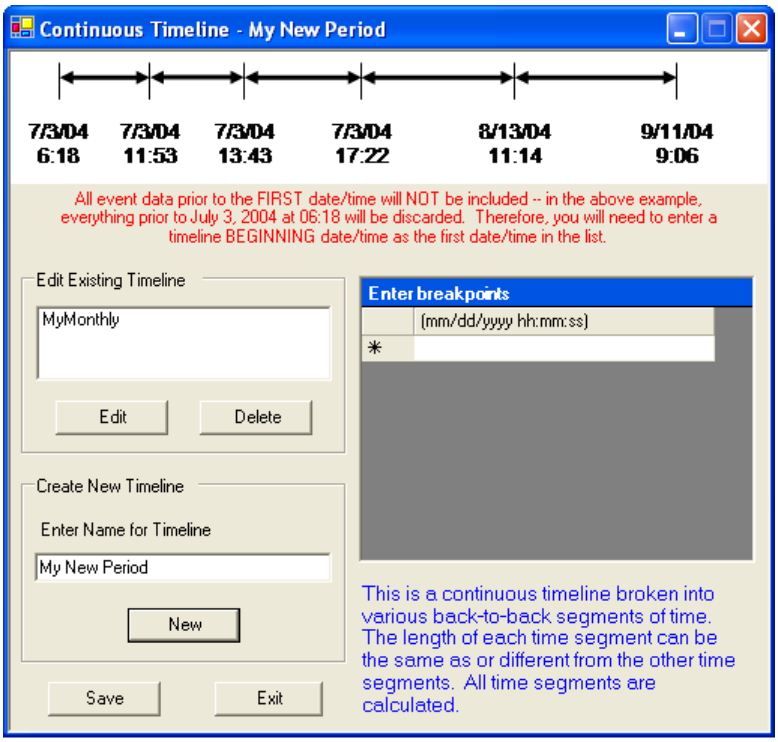

Figure 14. Continuous Timeline

To create a new timeline, type the name for the timeline in the text box under **Enter Name for Timeline** and click **New**. Enter the break points in the grid on the right.

In the example shown at the top of the form, you would enter the following break points:

7/3/2004 06:18

7/3/2004 11:53

7/3/2004 13:43

7/3/2004 17:22

8/13/2004 11:14

9/11/2004 09:06

The calculations would proceed as follows:

1. All hours before 07/03/2004 at 06:18 would not be included in the results tables. 07/03/2004 at 06:18 is the beginning of the timeline set.
2. Hours after 09/11/2004 at 09:06 would be calculated through the end of the current reporting month (if the calculations were run on November 5, 2004, the hours would reflect the entire period 09/11/2004 at 09:06 through October 31, 2004 at 23:59:59, since October is assumed to be the end of the current reporting month).
3. The results tables would show the hours and statistics for each of the six periods listed above (the last period being 09/11/2004 at 09:06 to the end of the current reporting month) for the units assigned to this timeline period set.

Very Important Note

To save the period set, click **Save**.

To edit an existing set, highlight the set's name in the list box in **Edit Existing Timeline** and click **Edit**.

Very Important Note

After you have made the necessary change, click **Save** to save the changes back to the server database.

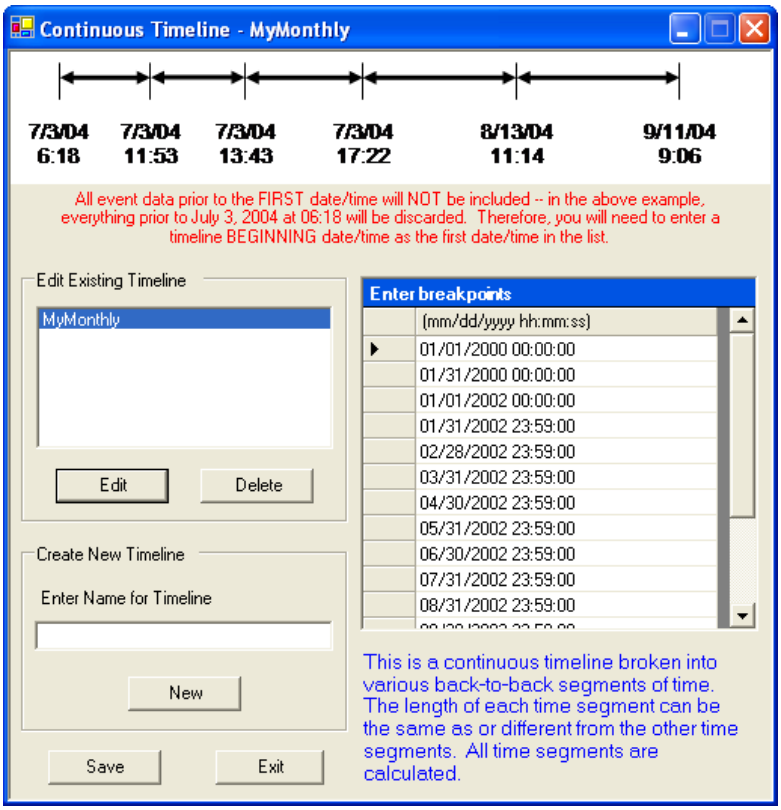

Figure 15. Continuous Timeline Example

To delete an existing set, highlight the set's name in the list box in **Edit Existing Timeline** and click **Delete**.

Discrete Periods

These are discrete time periods with each period having a distinct starting date/time and ending date/time. Generally, there are gaps between each distinct period. Only the discrete time periods are calculated; the gaps are not. The time periods cannot overlap one another.

Discrete period analysis is useful in a number of ways. Suppose your company is planning to obtain either capacity or energy contracts for next summer's peak. You know that generating units can hang on during peak summer days' peak hours, so simply calculating the monthly average EFOR or EAF during the summer months will more than likely overestimate the capacity or energy requirements. This might result in contracting for too much capacity or energy, at an unnecessary cost to your company. Instead, a better way to estimate is to look at specific dates or time of day during the summer's peak days.

For example, you can calculate the statistics for 25 peak periods, scattered over the last 2 years. You can also, calculate the average of only the 25 peak periods, combined—ignoring the gaps between them.

The peak periods can be on the same day (such as a morning peak and an afternoon peak), on consecutive days, or they can be days, weeks, months, or even years apart. They can be as long or as short as you want (the shortest period allowed is one minute).

You can have an unlimited number of pre-defined period sets. These different sets are defined in a table in the database. Each unit can have its own set of discrete periods, identified in the **Unit Setup Console**.

When the calculations are run, each unit will have statistics calculated for each defined subperiod; no statistics are calculated for the gaps between subperiods.

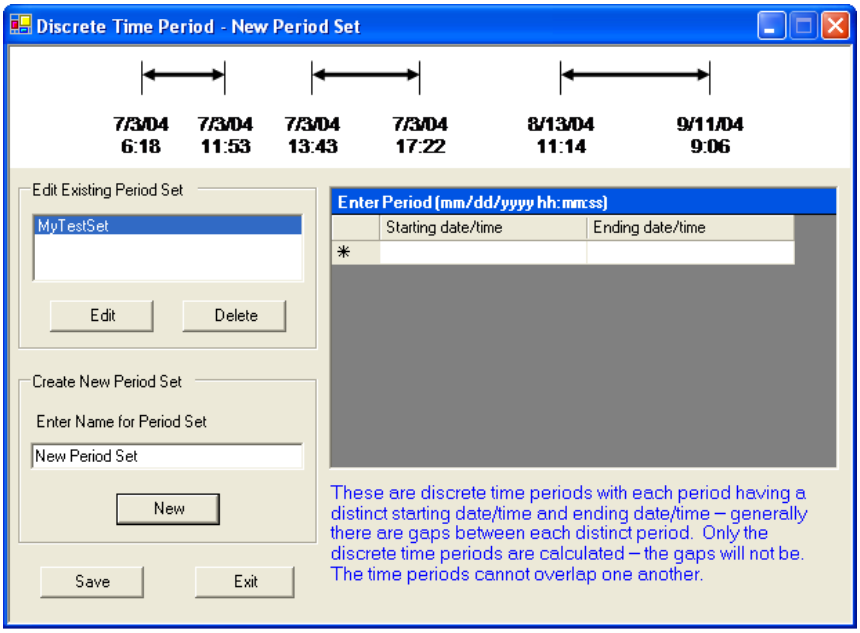

Figure 16. Discrete Time Periods

To create a new period set, type the name for the set in the text box under **Enter Name for Period Set** and click **New**. Enter each period's starting date/time and ending date/time in the grid on the right.

In the example shown at the top of the form, you would enter the following Starting date/times and Ending date/times respectively:

7/3/2004 6:18	7/3/2004 11:53
7/3/2004 13:43	7/3/2004 17:22
8/13/2004 11:14	9/11/2004 9:06

The calculations would proceed as follows:

1. All hours between 07/03/2004 at 06:18 and 7/3/2004 11:53, between 7/3/2004 13:43 and 7/3/2004 17:22, and between 8/13/2004 11:14 and 9/11/2004 09:06 would be included in the results tables. The period before 7/3/2004 06:18, the gaps between each set, and the time after 9/11/2004 09:06 are ignored.
2. The results tables would show the hours and statistics for each of the three periods listed above for the units assigned to this period set.

Very Important Note

To save the period set, click **Save**.

To edit an existing set, highlight the set's name in the list box in **Edit Existing Timeline** and click **Edit**.

Very Important Note

After you have made the necessary change(s), click **Save** to save the changes back to the server database.

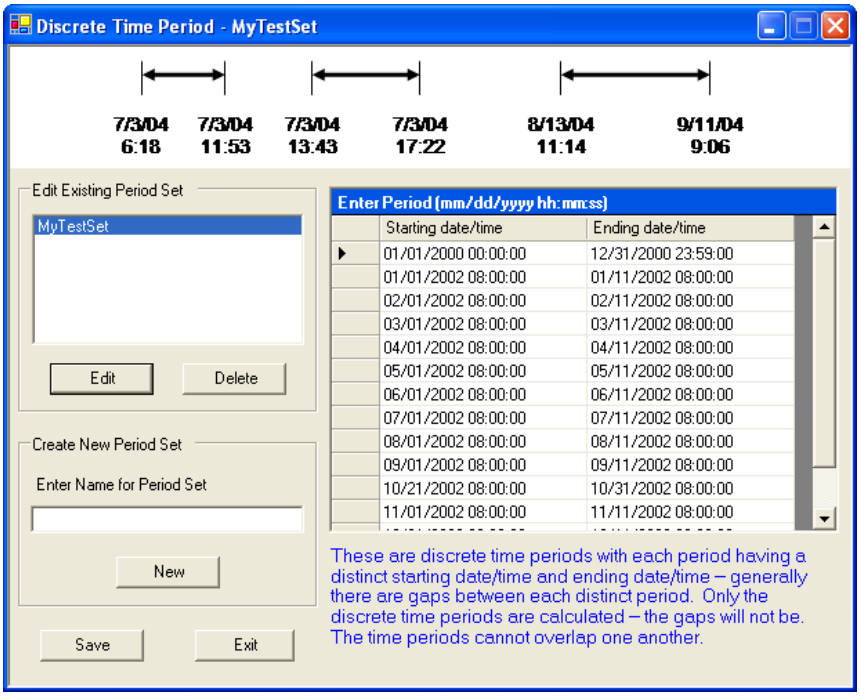

Figure 17. Discrete Time Period Example

To delete an existing set, highlight the set's name in the list box in **Edit Existing Timeline** and click **Delete**.

List All Sets

The **List All Sets** command displays a two-part form listing the period set name and break points for the continuous timeline and the starting and ending date/times for the discrete period sets. **Refresh** reloads the display from the master database table.

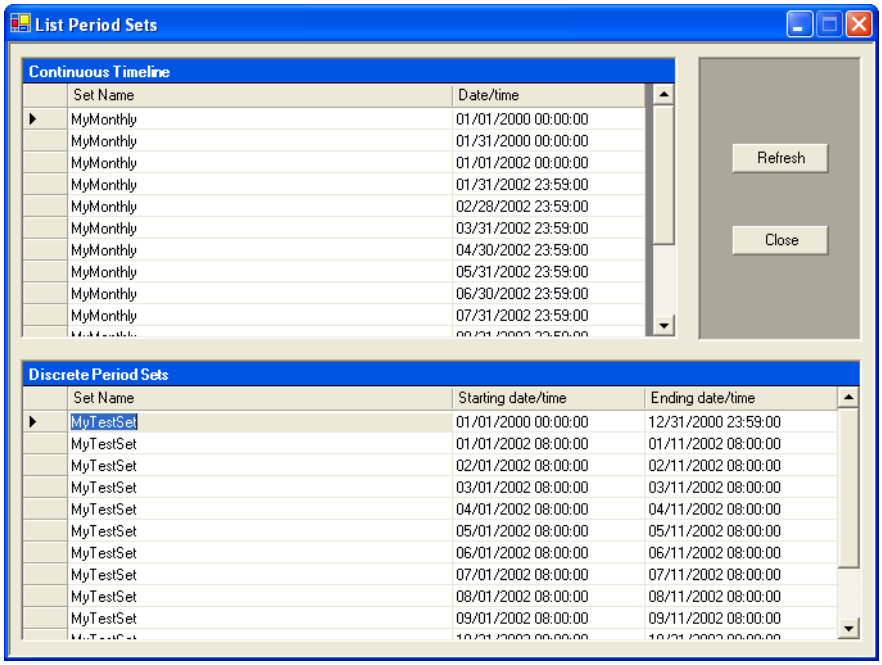

Figure 18. List All Sets

Generate Reports

The standard reports included with GADS Open Source Analysis & Reporting provide listings of similar data in traditional and historical groupings. The standard reports have been designed based on suggested analysis needs from historical NERC GATE and GADS reports; on layouts and designs in the 1980s from NERC and industry COBOL mainframe reports; and on traditional listings of similar factors, rates, and data found throughout the industry.

Because Analysis & Reporting stores the calculated results in industry-standard databases, it is easy to create customized reports. This user manual includes the table structures as well as a data dictionary identifying the fields and the data that can be used to create any custom reports you choose.

All reports are generated with Crystal Reports (CR) and are displayed in the CR report viewer. Therefore, they all share the common controls described below:

Crystal Reports Report Viewer

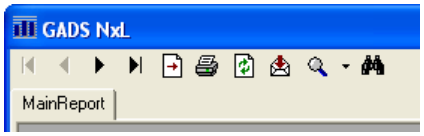

Figure 19. CR Control Menu

From left to right, the controls are:

- First page (disabled on first page)
- Previous page (disabled on first page)
- Next page
- Last Page
- Goto Page (enter a page number to go to)
- Close Current View
- Print Report
- Refresh
- Export – allows you to export the report into Adobe Acrobat (.PDF), Microsoft Excel (.xls), Microsoft Word (.doc) and Rich Text Format (.rtf) files, as shown in Figure 20.

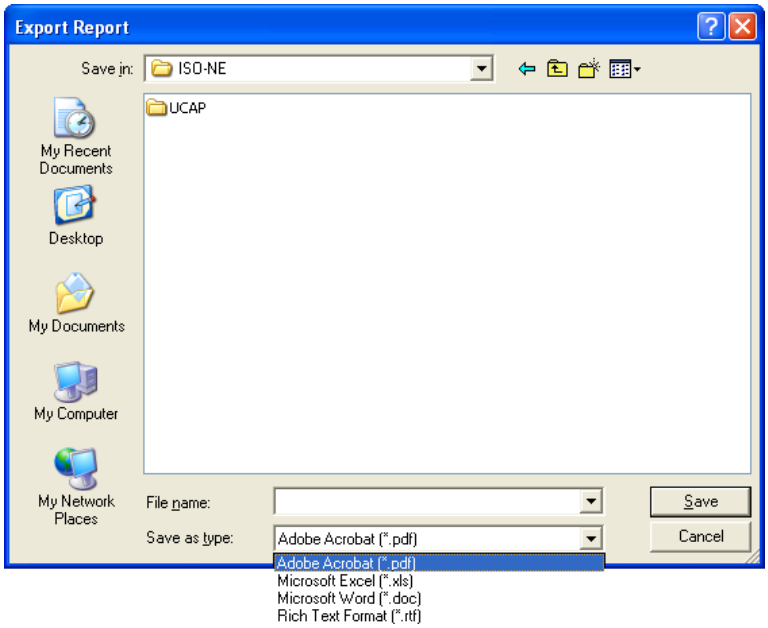

Figure 20. Export Report File Formats

- Zoom (increases/decreases the report display within the report viewer)
- Search Text (enter text and the report viewer will find it in the report)

Important Calculation Notes

In other GADS analysis systems, you may be required to re-calculate the entire historical data set each time you want to change, for example, from monthly to annual reports.

Very Important Note

During the GADS Open Source Analysis & Reporting setup process, you can select which granularities (such as monthly, yearly, ,etc.) are calculated each time the calculations are run. These granularities become a part of the standard calculation process and are stored in the database tables. As a result, reports are very fast; changing from monthly to annual reports and back again is simply a matter of extracting data that is already calculated and stored in the tables.

Select Reports

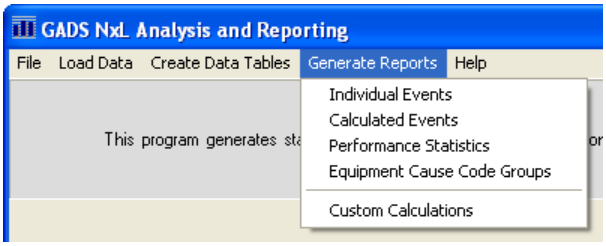

Figure 21. Generate Reports Menu

There are four groups of reports from which you can choose. The available reports and their content can be varied in some cases, based on the settings and options chosen. The four groups are:

1. Individual Events
2. Calculated Events
3. Performance Statistics
4. Equipment Cause Code Groups

Before discussing the four report groups, the selection forms common to all four report groups will be described in more detail.

Cause Code Selection

Since these methods act as "filters," not selecting one of these three options means you get ALL cause codes in the reports.

Several (but not all) reports allow you to filter the events that are included.

If the report is a listing of the individual event records or groups the event records for various cause codes, you will be able to filter which event records will be displayed in the reports.

There are three sets of cause code filter selection forms:

1. **Custom Cause Code Ranges** – allows you to enter ad hoc custom beginning and ending cause code ranges. There are no pre-defined groups and your selections are not saved.
2. **User-defined Cause Code Range Groups** – allows you to pick one or more cause code range groups defined in the **Analysis Admin Console**. When you create this single grouping, it is saved and applied to all units being calculated or reported. During the calculations, all the groups are used to fill in the EquipGroupName fields in the EventDetails and EventRecords tables.

3. **NERC GADS Standard Cause Code Groups** – allows you to pick one or more NERC GADS standard cause code groups, already defined in the NERC GADS Data Reporting Instructions in Appendix B.

These cause code filters are described in more detail in the following sections.

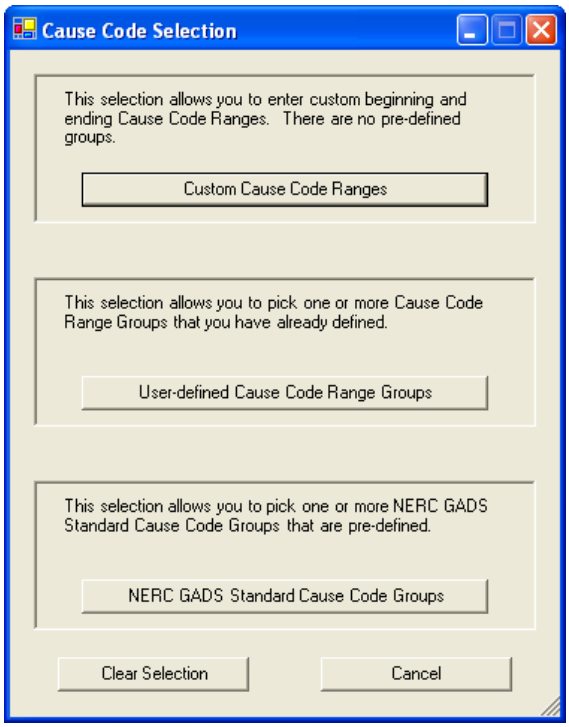

Figure 22. Cause Code Group Selection

If you have selected specific cause code ranges, the display above **Cause Code Selection** changes as shown in Figure 23 indicating **Cause Codes Selected**:

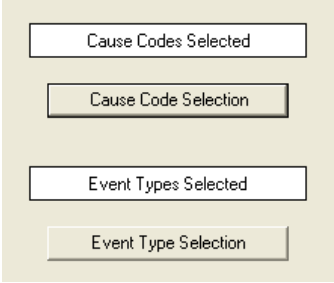

Figure 23. Cause Codes/Event Types Selected Indicators

Custom Cause Code Ranges

The **Custom Cause Code Ranges** screen allows you to create custom cause code ranges by entering beginning and ending cause code values and indicating whether this range is to be included or excluded in the report. There are no pre-defined groups.

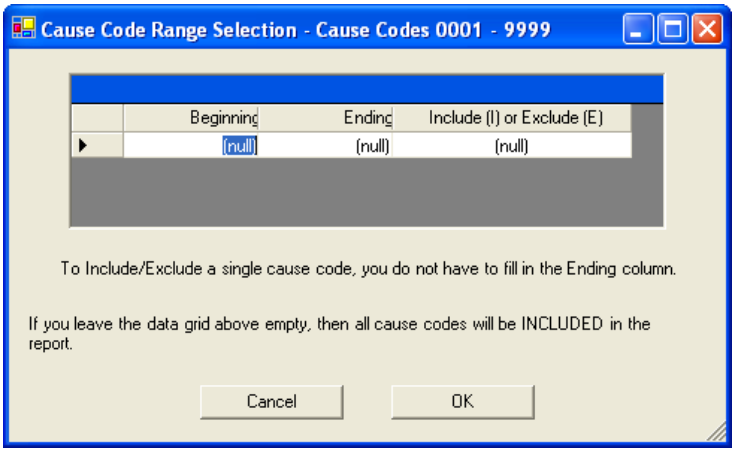

Figure 24. Custom Cause Code Ranges Selection Screen

To create a custom group for boiler tube leaks (cause codes 1000–1090 and 1350), fill in the form as follows:

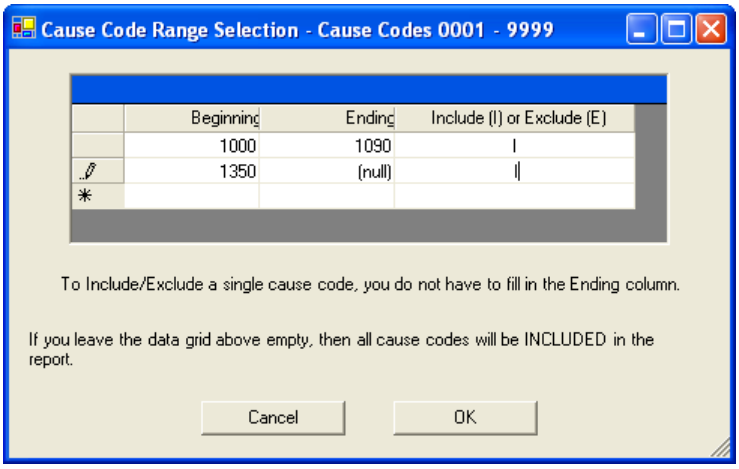

Figure 25. Select Custom Cause Code Ranges Example 1

To create a custom group for the boiler that **excludes** the boiler tube leaks, fill in the form as shown in Figure 26.

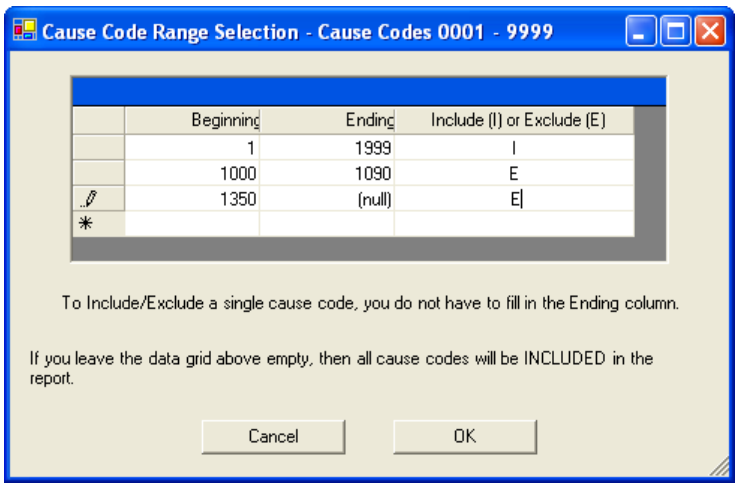

Figure 26. Select Custom Cause Code Ranges Example 2

Defined ranges can overlap, as shown in the example above.

Use an *I* to include the range of cause codes in the report and an *E* to exclude (or filter out) the range of cause codes from the report.

You can include or exclude a single cause code by entering a value only in the Beginning column.

When you run the report, only the events that meet the cause code selection criteria will be displayed.

User-Defined Cause Code Range Groups

The **User-Defined Cause Code Range Groups** screen allows you to select one or more pre-defined cause code groups. These groups are created in the **Analysis Admin Console**. Default groups are supplied with the software and can be modified as desired (refer to the Administrative Console section for details).

Select one or more of these groups by highlighting it. You can select multiple groups by holding down the CTRL key and using your mouse to click on as many individual groups as desired.

Figure 27 shows the default groups supplied with the initial installation. If you modify the groups, the list you see on this screen will be different.

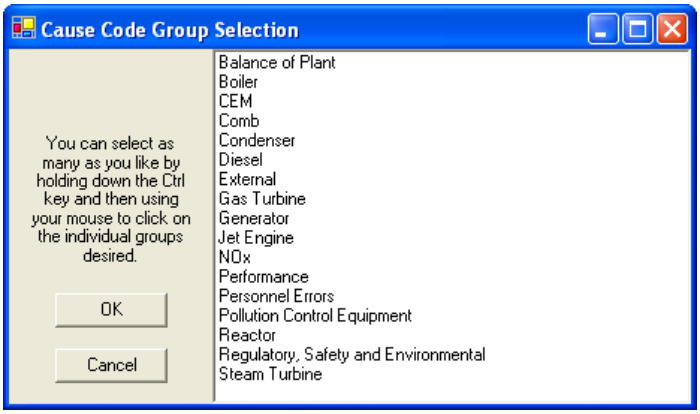

Figure 27. User-Defined Cause Code Range Groups

NERC GADS Standard Cause Code Groups

The **NERC GADS Standard Cause Code Groups** screen allows you to select one or more pre-defined cause code groups. These groups are defined in the NERC GADS DRI in Appendix B.

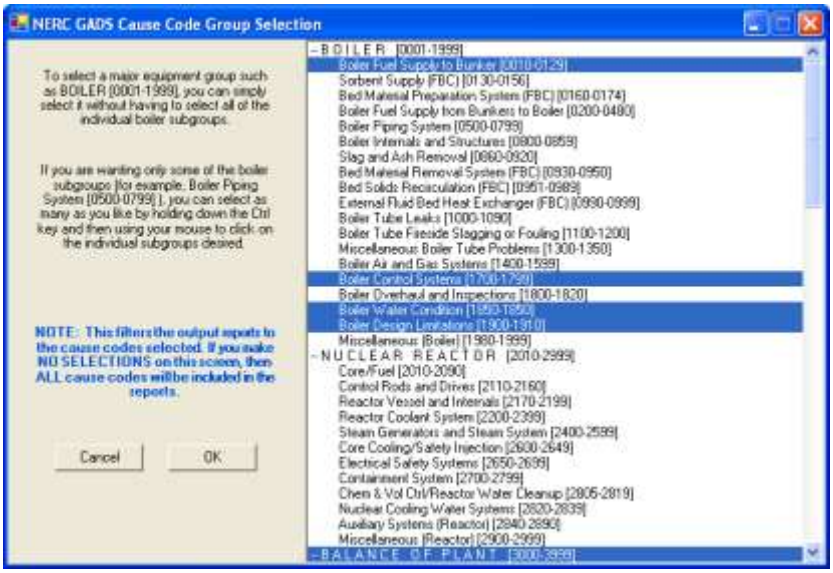

Figure 28. Select Cause Code Groups from NERC GADS Standard List

Select one or more of of the major or minor groups by highlighting them. As illustrated in Figure 28, you can select multiple groups by holding down the CTRL key and using your mouse to click on as many individual groups as desired.

Groups are arranged into major and minor groups. Major groups are shown in all caps with a "**—**" in front of the item in the list. Minor groups are indented and displayed immediately below the major group title. When you select a major group, it automatically includes all of the minor groups or subgroups beneath it.

To select a major equipment group such as BOILER [0001-1999], you can simply select it, without having to select all the individual boiler subgroups.

If you want only some of the boiler subgroups, you can select as many as you like. If you end up selecting all of the subgroups, you can either leave it as is, or unselect the subgroups and then select the major group that encompasses all of these subgroups.

Event Type Selection

Since these methods act as "filters," not making a selection means you will get ALL cause codes in the reports.

Several reports allow you to filter the events included in the report; not all reports do.

If the report is a listing of the individual event records, or if the event records are grouped by event types, then you can filter which event records will be displayed in the reports.

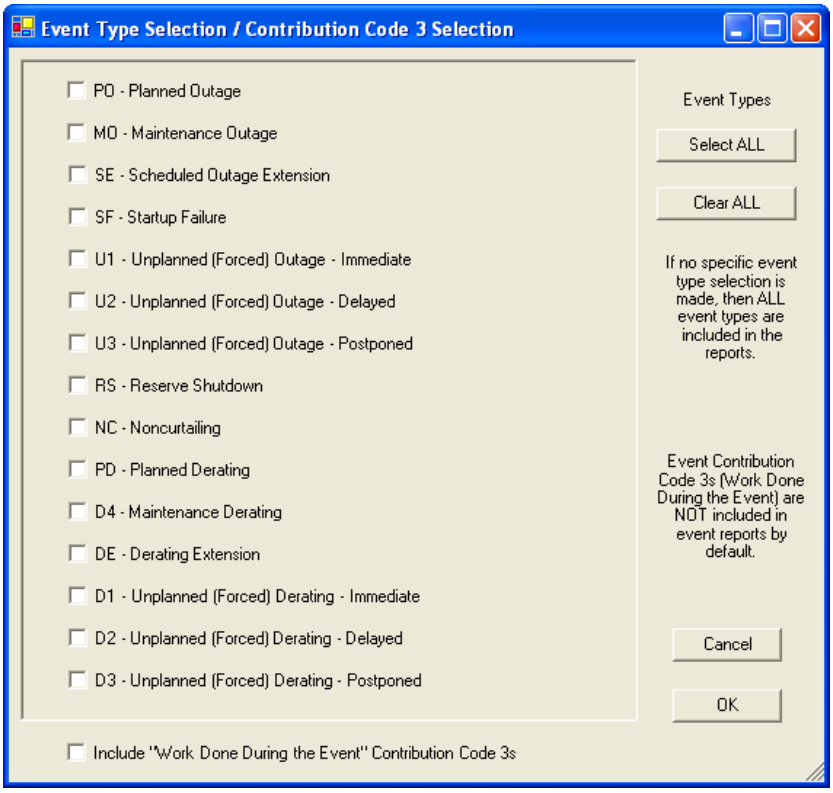

Figure 29. Select Event Types

To include "Work Done During the Event" Contribution Code 3 event records in the reports, check the box at the bottom of the form; the default is to not show these records (unchecked).

If you wanted to list on the reports only forced outages, you would check the boxes next to U1, U2, and U3. If you also wanted Startup Failures, you would also check the box next to SF.

When you are finished with your selections, click **OK**.

If you have selected specific event types, the display above **Event Type Selection** changes as shown in Figure 30, indicating **Event Types Selected**:

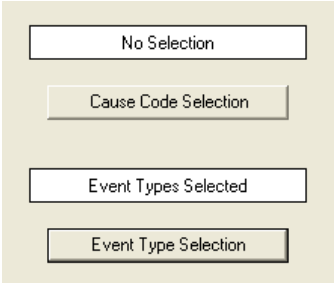

Figure 30. Cause Codes/Event Types Selected Indicators

Individual Events

For event-related reports, the equivalent hours shown in the reports are for the entire duration of the event.

You can screen or filter the events included in the report based on the event's span relative to the Reporting Window, defined by the two date/time boxes shown graphically at the beginning and end of the Reporting Window.

When you select Individual Events, the form shown in Figure 31 is displayed:

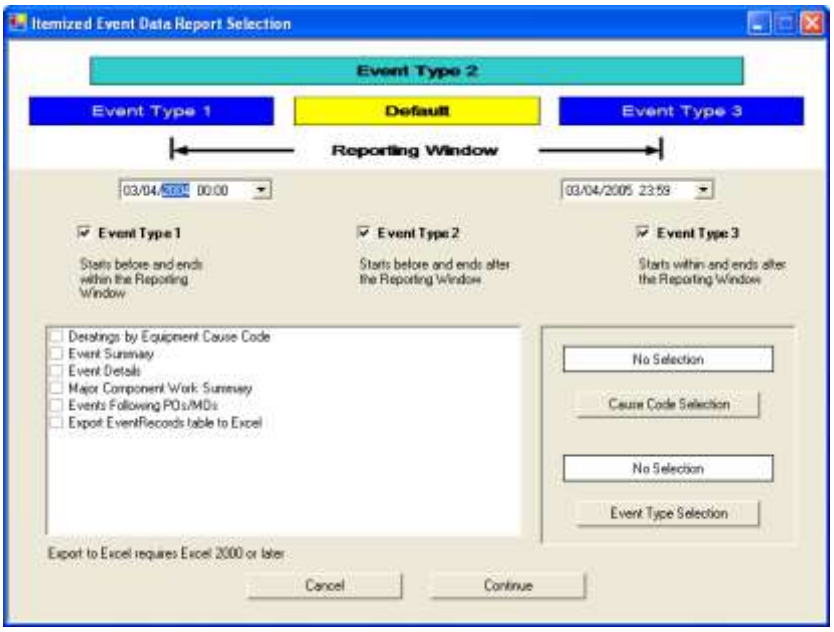

Figure 31. Select Itemized Event Data Reports

The Event Type 1, Event Type 2, and Event Type 3 check boxes define the event "overlap" with the Reporting Window, that causes the event to be included in the report. The Default always includes events that begin and end within the Reporting Window.

When Event Type 1 is checked, all events that start before the Reporting Window and end within the Reporting Window are also included.

When Event Type 2 is checked, all events that start before the Reporting Window and end after the Reporting Window are also included.

When Event Type 3 is checked, all events that start within the Reporting Window and end after the Reporting Window are also included.

By default, all three are checked when the form displays.

To change either date/time value that defines the Reporting Window, you can:

1. type in the values
2. highlight the month, day, year, hour, or minute value and use the UP or DOWN arrows on your keyboard to cycle through the accepted values. In Figure 33, the year field is highlighted. Using the UP or DOWN arrow keys you can change the year. By highlighting the month, you can cycle through the values 1 through 12 until you reach the desired month

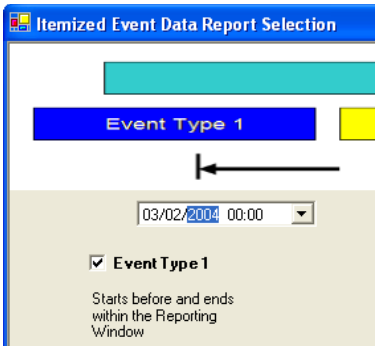

Figure 33. Change Date/Time Values

3. pop up a calendar for the date portion by clicking on the down arrow just to the right of the time value in either date/time field, as shown in Figure 32. Use the calendar controls to adjust the calendar to the desired date; the date is automatically loaded into the field.

Figure 32. Pop-Up Calendar

The reports available are shown in the list box on the lower left side. Choose one or more of these reports by checking the box next to the report's name.

When you are ready, click **Continue**; otherwise you can cancel the process and return to the main form by clicking **Cancel**.

Individual Events – Deratings by Equipment Cause Code

This report allows you to determine the causes for unit deratings. All derating event types and cause codes will be listed unless specific types and codes have been selected.

The Total Event Duration (clock hours) and the Equivalent Derated Hours are for the entire event.

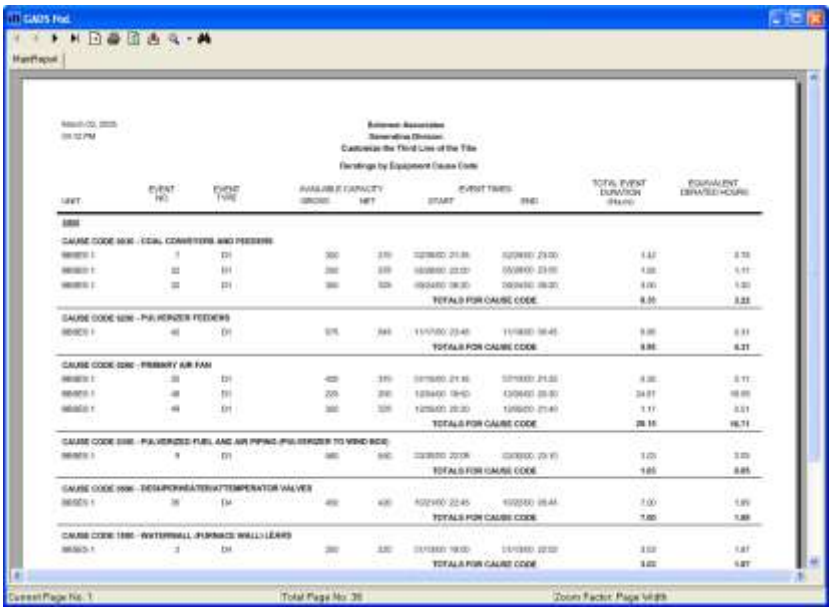

Figure 34. Individual Events – Deratings by Equipment Cause Code

This report includes:

- Cause code
- Unit short name
- Event number
- Event type
- Gross available capacity
- Net available capacity
- Start of event date/time
- End of event date/time
- Total event duration in hours
- Equivalent derated hours

Individual Events – Event Summary

This report lists a one-line summary of each event record and allows you to determine the causes for unit deratings and outages. All event types and cause codes are listed unless specific event types and cause codes have been selected.

The Equivalent Hours are for the entire event.

Highlighting an item on the report viewer displays a ToolTip indicating which table field was used to create the item.

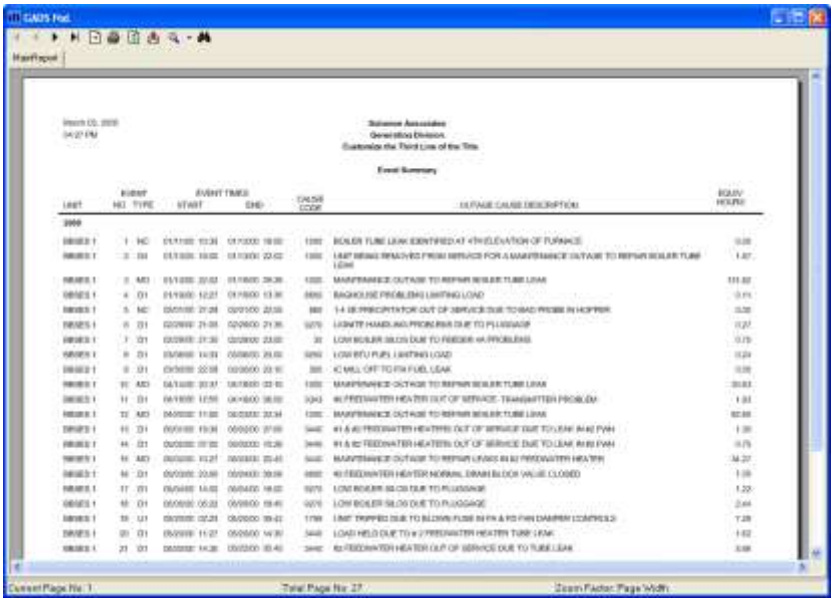

Figure 35. Event Summary Report

This report includes:

- Unit short name
- Event number
- Event type
- Start of event date/time
- End of event date/time
- Cause code
- Outage cause description
- Equivalent hours

Individual Events – Event Details

This report lists details of each event record and allows you to determine the causes for unit deratings and outages. All event types and cause codes are listed unless specific event types and cause codes have been selected.

The Duration Total and Equivalent Hours are for the entire event. Contribution Code 3s are listed if this option is selected before reports are generated.

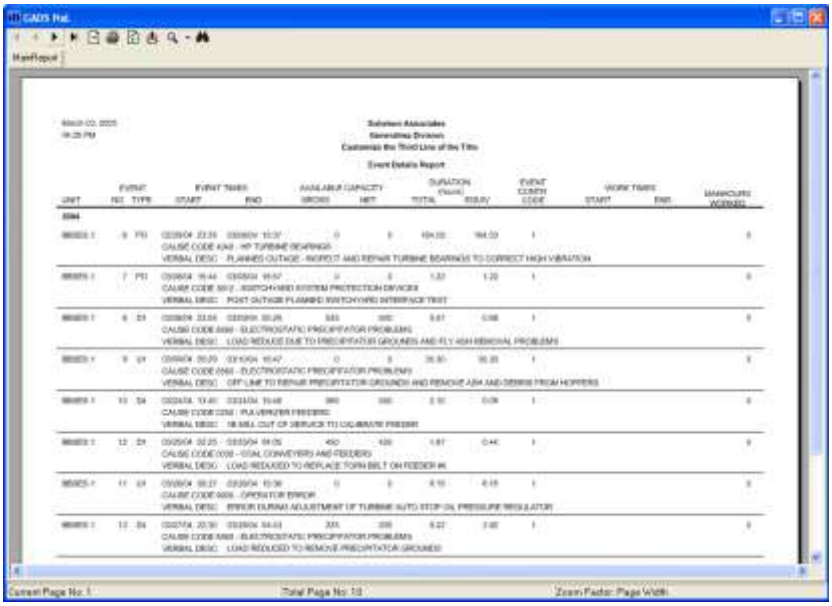

Figure 36. Event Details Report

This report includes:

- Year
- Unit short name
- Event number
- Event type
- Start of event date/time
- End of event date/time
- Gross available capacity
- Net available capacity
- Total duration (clock hours)
- Equivalent duration (equivalent hours)
- Event contribution code
- Work times – start date/time
- Work times – end date/time
- Hours worked

Individual Events – Major Component Work Summary

This report groups events by GADS cause code for the selected event types and cause codes.

The Duration Total and Equivalent Hours are for the entire event.

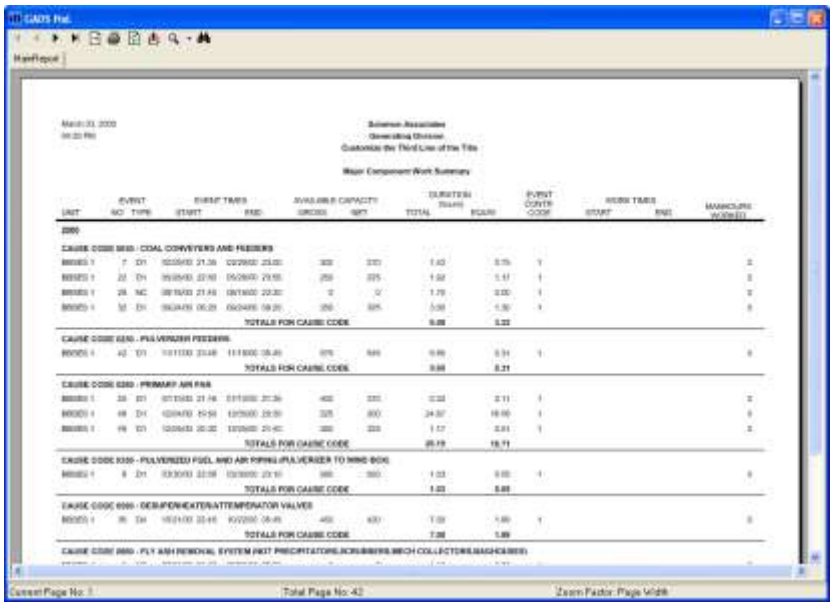

Figure 37. Major Component Work Summary Report

This report includes:

- Year
- Cause code and cause code description
- Unit short name
- Event number
- Event type
- Start of event date/time
- End of event date/time
- Gross available capacity
- Net available capacity
- Total duration (clock hours)
- Equivalent duration (equivalent hours)
- Event contribution code
- Work times – start date/time
- Work times – end date/time
- Hours worked

Individual Events – Events Following POs/MOs

This report is a cross-tabulation of the time between the PO or MO and the Forced Outage, and the duration of the Forced Outage showing the number of occurrences that fall within both the time and the duration criteria. It documents the frequency and severity of forced outages that occur immediately after PO and MO events.

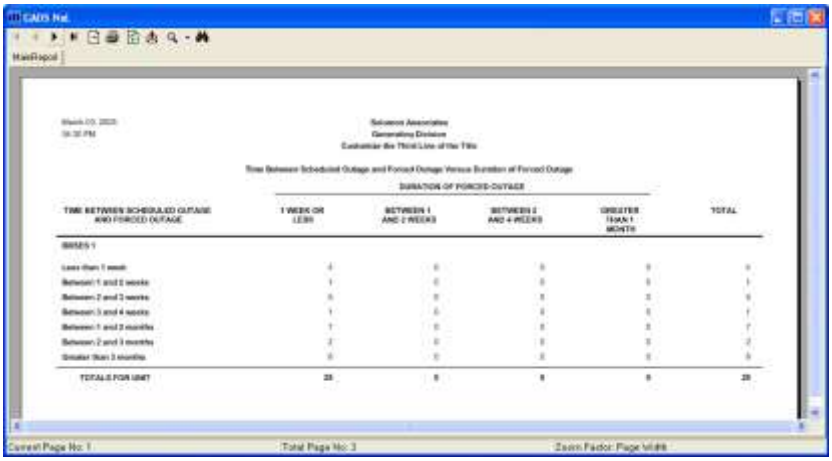

Figure 38. Time Between Scheduled Outages and Forced Outages vs Duration of Forced Outages Report

Reference: Generating Availability Trends Summary Report
Study 4 – Frequency and Severity of Forced Outages Immediately Following Planned or Maintenance Outages
Generating Availability Trends Evaluation Working Group (GATE)
May 1989

Reference: Generating Unit Availability Following Planned Outages
Causes of Electric Generating Unit Forced Outages Following Planned Outages
Forced Outages Following Scheduled Outages Task Force
Generating Availability Trends Evaluation Working Group (GATE)
June 1992

Calculated Events

These reports include the various granularities calculated during the standard production processing. The form in Figure 39 shows only Monthly, Yearly (Annual), and Peak Periods enabled. These are the only granularities calculated during the standard production processing.

If you wish to add the Quarterly granularity to the reports, you must use the **Analysis Admin Console** to add Quarterly to the appropriate group(s). When the calculations are re-run, Quarterly will be listed as available for reports.

Calculating stores the calculated results for all selected granularities in the database tables; therefore, running reports is simply a matter of extracting the previously calculated statistics and data from the database tables. This saves time when running reports for monthly departmental reporting, which typically requires a mix of monthly, yearly, and peak period reports.

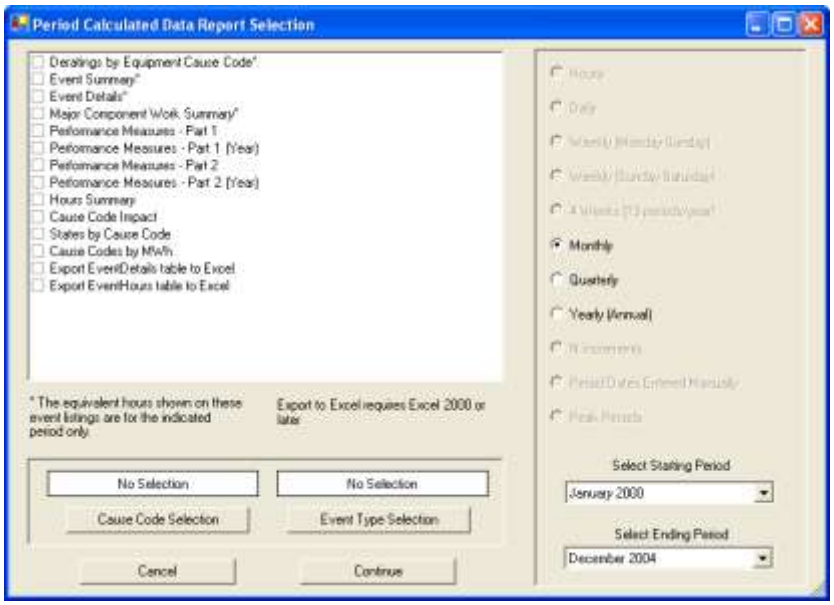

Figure 39. Select Calculated Event Report

Calculated Events – Deratings by Equipment Cause Code

This report allows you to determine the causes for unit deratings. All derating event types and cause codes will be listed unless specific types and codes have been selected.

The Total Event Duration (clock hours) and the Equivalent Derated Hours are for the defined period range only.

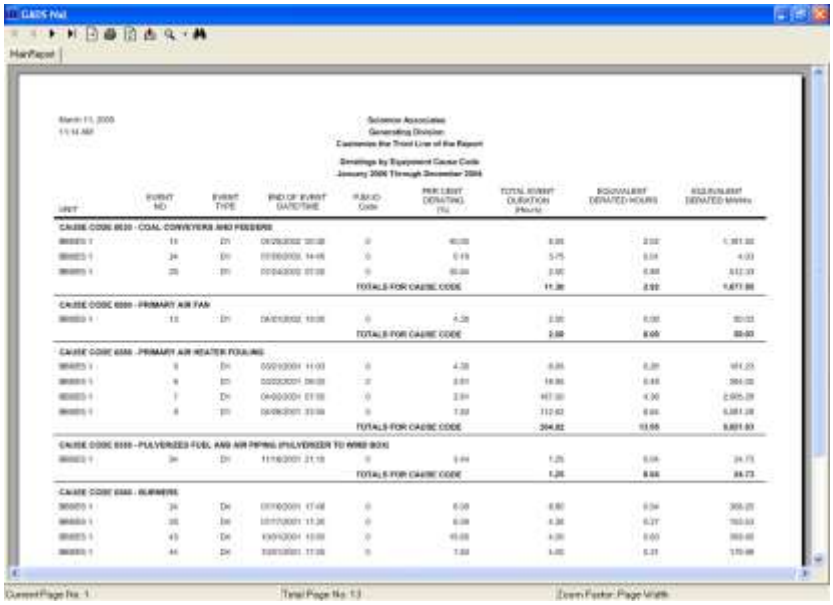

Figure 40. Deratings by Equipment Cause Code Report

This report includes:

- Cause code
- Unit short name
- Event number
- Event type
- End of event date/time
- PJM IO Code
- Percent derating
- Total event duration in hours
- Equivalent derated hours
- Equivalent derated MWh

Calculated Events – Event Summary

This report lists a one-line summary of each event record and allows you to determine the causes for unit deratings and outages. All event types and cause codes are listed unless specific types and codes have been selected.

The Equivalent Hours are for the defined period range only.

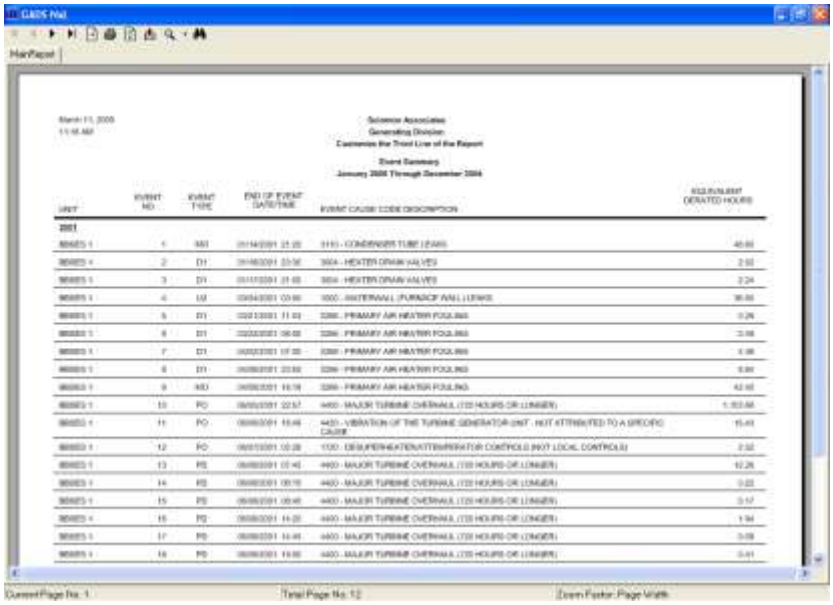

Figure 41. Events Summary Report

This report includes:

- Year
- Unit short name
- Event Number
- Event Type
- End of event date/time
- Cause code description (NERC GADS)
- Equivalent derated hours (for full outages this is also the clock hours)

Calculated Events – Event Details

This report lists details of each event record and allows you to determine the causes for unit deratings and outages. All event types and cause codes are listed unless specific types and codes have been selected.

The Duration Total and Equivalent Hours are for the defined period only. Contribution Code 3s are listed if this option is selected before reports are generated.

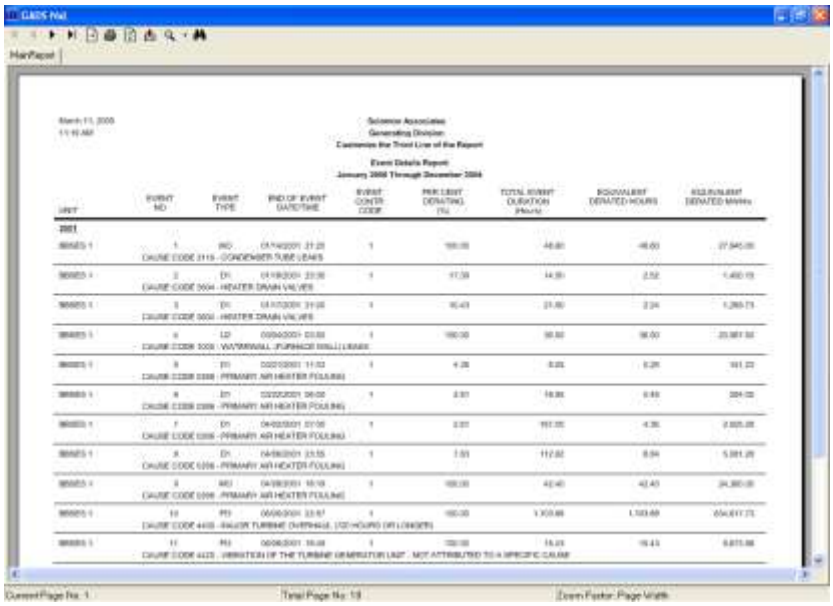

Figure 42. Event Details Report

This report includes:

- Year
- Unit short name
- Event Number
- Event Type
- End of event date/time
- Event contribution code
- Percent derating
- Total event duration (clock hours)
- Equivalent derated hours (for full outages this is also the clock hours)
- Equivalent derated MWh
- Cause code description (NERC GADS)

Calculated Events – Major Component Work Summary

This report groups events by GADS cause code for the selected event types and cause codes.

The Duration Total and Equivalent Hours are for the defined period only.

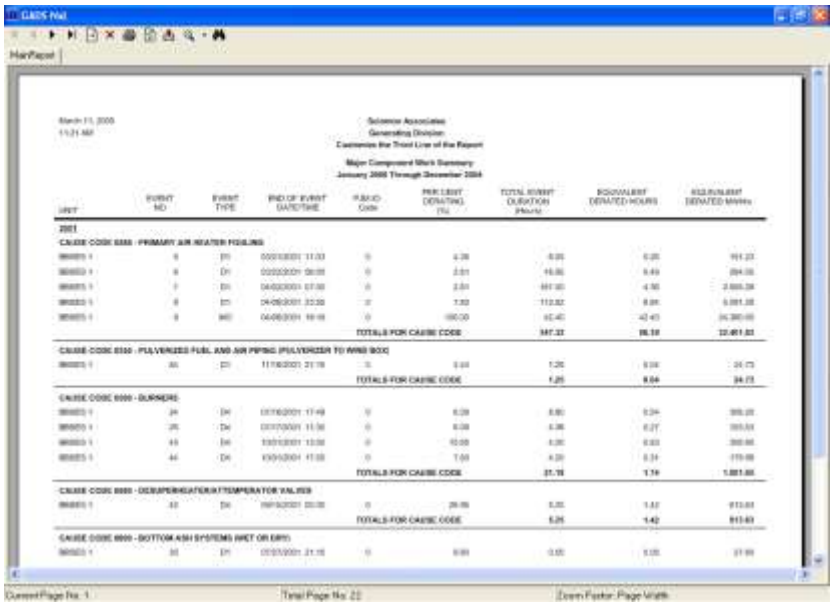

Figure 43. Major Component Work Summary Report

This report includes:

- Year
- Cause code and cause code description
- Unit short name
- Event number
- Event type
- Start of event date/time
- End of event date/time
- Gross available capacity
- Net available capacity
- Total duration (clock hours)
- Equivalent duration (equivalent hours)
- Event contribution code
- Work times – start date/time
- Work times – end date/time
- Hours worked

Calculated Events: Performance Measures – Part 1

This report displays performance measures (indexes) from the event and performance data. These statistics are based on IEEE Standard 762 "Definitions for Use in Reporting Electric Generating Unit Reliability, Availability and Productivity."

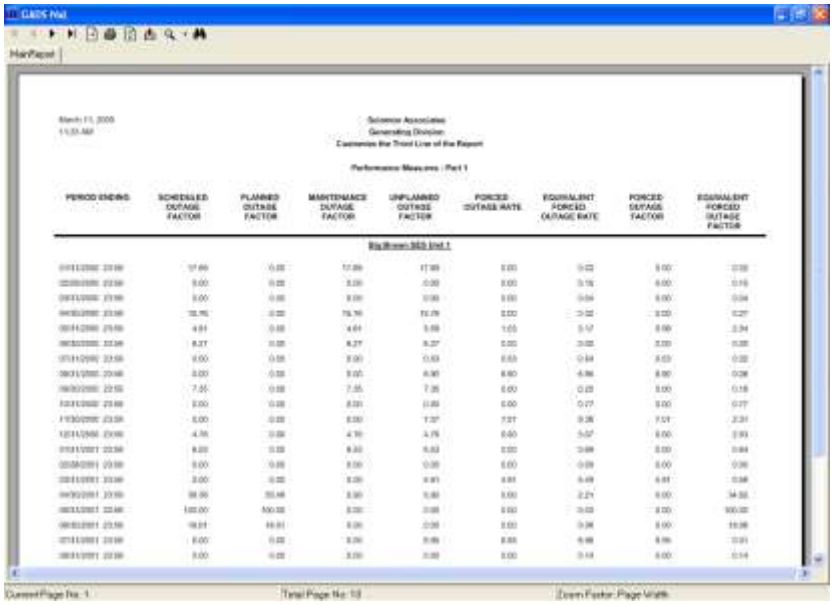

Figure 44. Performance Measures Report, Part 1

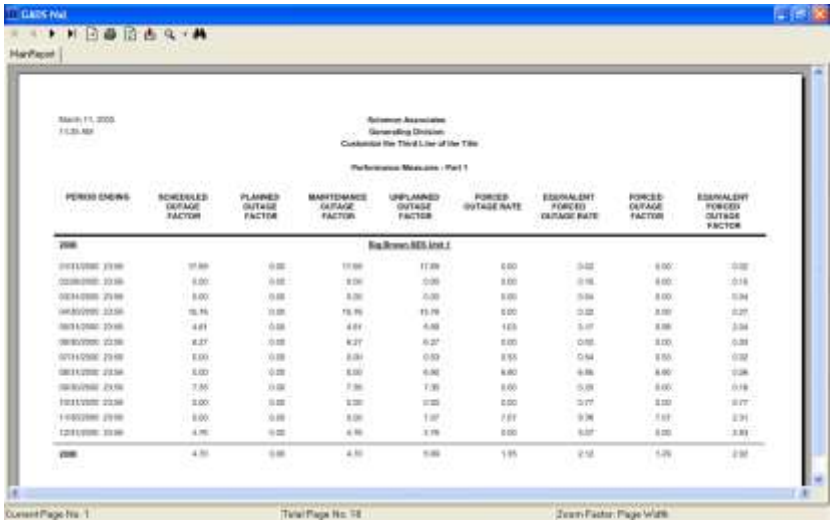

Figure 45. Performance Measures Report, Part 1 (Year)

This report includes:

- Unit name
- Period ending date/time
- Scheduled Outage Factor
- Planned Outage Factor
- Maintenance Outage Factor
- Unplanned Outage Factor
- Forced Outage Rate
- Equivalent Forced Outage Rate
- Forced Outage Factor
- Equivalent Forced Outage Factor

Calculated Events: Performance Measures – Part 2

This report displays performance measures (indexes) from the event and performance data. These statistics are based on IEEE Standard 762 "Definitions for Use in Reporting Electric Generating Unit Reliability, Availability and Productivity."

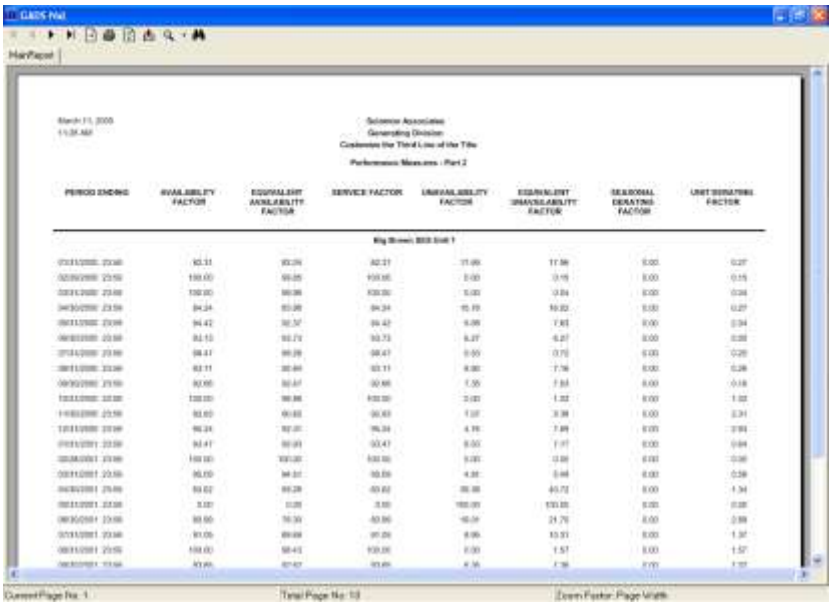

Figure 46. Performance Measures Report, Part 2

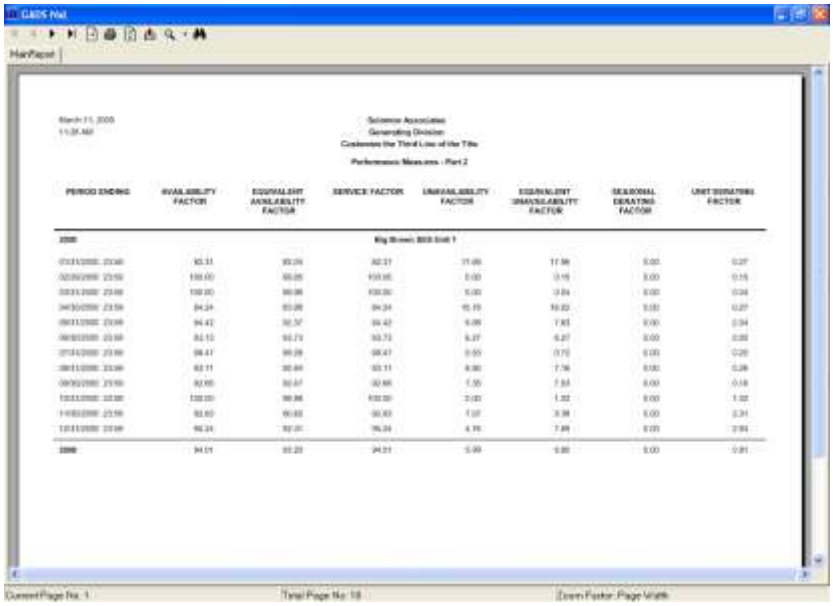

Figure 47. Performance Measures Report, Part 2 (Year)

This report includes:

- Unit name
- Period ending date/time
- Availability Factor
- Equivalent Availability Factor
- Service Factor
- Unavailability Factor
- Equivalent Unavailability Factor
- Seasonal Derating Factor
- Unit Derating Factor

Calculated Events: Hours Summary

This report is structured similar to the NERC GADS Unit Report.

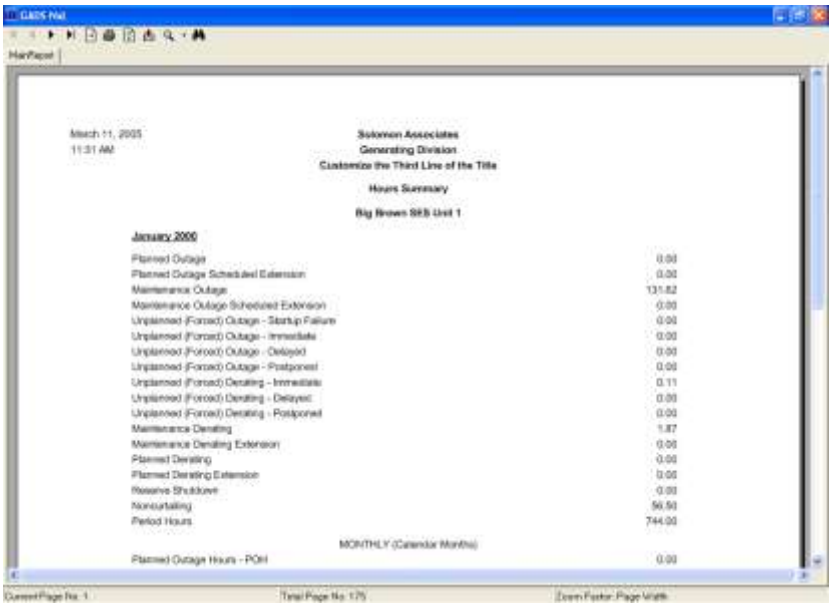

Figure 48. Hours Summary Report

Calculated Events: Cause Code Impact

This report summarizes the impact each cause code has had on the unit.

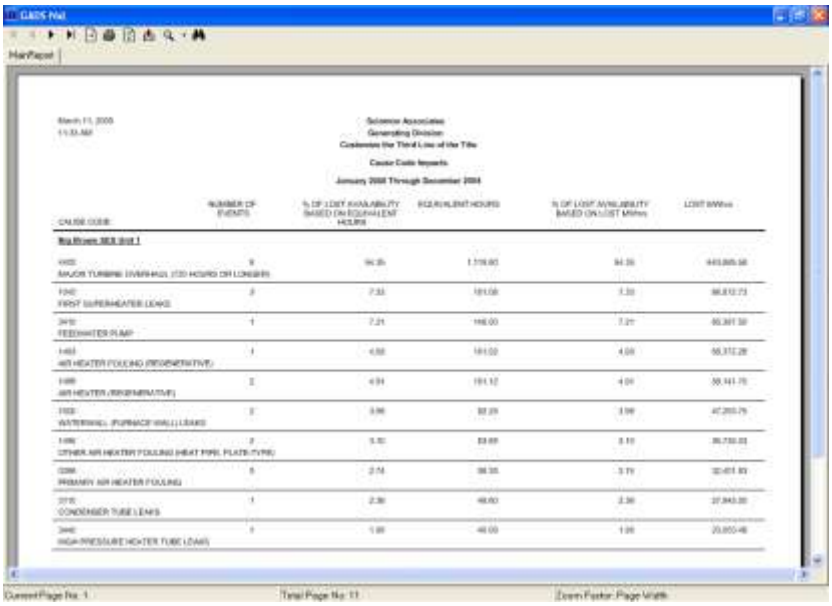

Figure 49. Cause Code Impact Report

This report includes:

- Unit name
- Cause code and description
- Number of events (both full outages and deratings)
- Percent of lost availability based on equivalent hours
- Equivalent hours (for full outages, equivalent hours are equal to clock hours)
- Percent of lost availability based on lost MWh
- Lost MWh

Calculated Events: States by Cause Code

This report tabulates for each cause code group the number of occurrences and outage hours for forced outages, planned outages, maintenance outages, forced deratings, and scheduled deratings. The planned outages, maintenance outages, and scheduled deratings include the applicable extensions.

The number of occurrences and the total number of outage hours can provide insight into the unit's failures. For example, a large number of occurrences combined with a relatively small number of hours could indicate systemic or chronic problems.

A small number of occurrences combined with a large number of hours could indicate severe catastrophic events, especially if the event type is a forced outage. If the type is planned or maintenance, then a small number of occurrences and a large number of hours indicate that overhauls or scheduled maintenance outages have occurred during the period.

Similar relationships exist with the derating categories.

This report is also useful when trying to determine which equipment groups are causing the most problems and what types of problems are being experienced. If a unit has a turbine that is experiencing a large number of unplanned (forced) outages, it may be helpful to know the types of turbine problems occurring, such as a identifying whether a unit is experiencing a myriad of small problems (i.e., large number of problems with few total hours).

Similarly, the boiler might have had major problems (few occurrences, but large number of total hours).

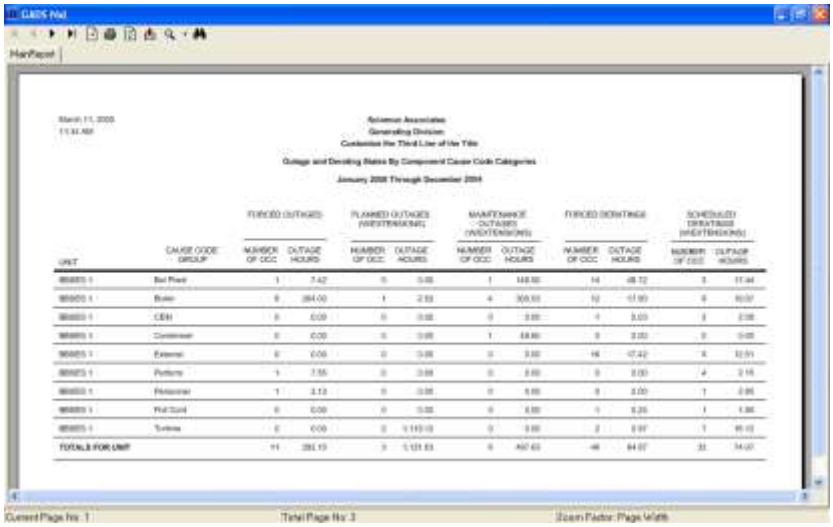

Figure 50. Outages and Derating States by Cause Code Categories Report

Calculated Events: Cause Codes by MWh

This report displays the MWh lost by major event type (forced outages, planned outages, maintenance outages, forced deratings, and scheduled deratings) in the indicated cause code groups.

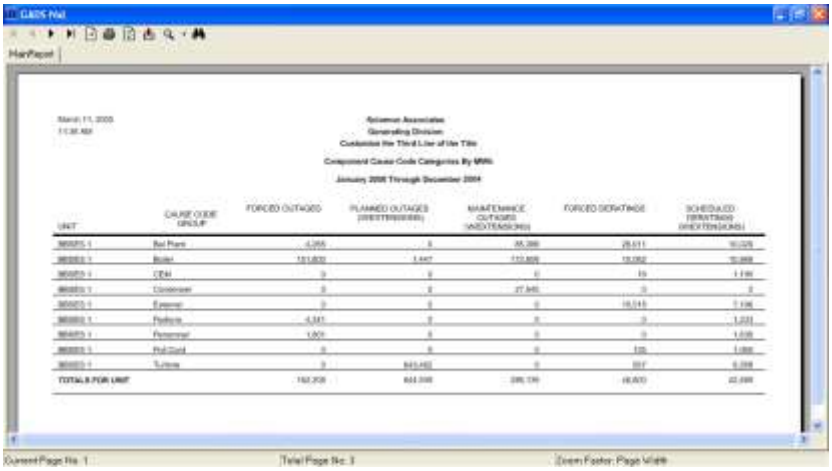

Figure 51. Component Cause Code Categories by MWh Report

Performance Statistics

These monthly reports are based on the GADS Performance records.

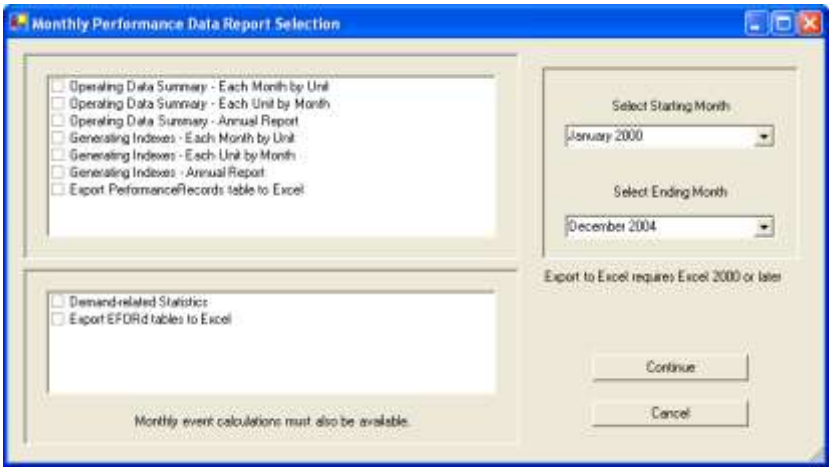

Figure 52. Select Performance Statistics Report

Performance Statistics: Operating Data Summary

The Operating Data Summary has three versions:

- Each month by unit
- Each unit by month
- Annual report

The data displayed in this report is based on the GADS Performance record data.

The Operating Data Summary and the Performance Measures reports together provide an excellent overall view of each generating unit's performance.

Trends in the Performance Measures report statistics can sometimes be explained by analyzing the trends on the Operating Data Summary.

For example, if a unit's EAF is increasing, it may simply be that the unit is not running as much as it has historically (less generation or lower number of service hours). A unit that is running less is less likely to fail.

Increasing the number of starts (either attempted or actual) can have an adverse impact on the equivalent forced outage rate (EFOR) if the unit was originally designed for baseload operation. Relationships between unit starts, unit reliability, and costs are very significant. This is especially true if the unit's operational requirements have changed since the unit was originally designed.

The unit's efficiency, as measured by the unit net or gross heat rate, is also listed on the report. An upward trend in heat rate adversely affects both the quantity of fuel burned and the busbar cost of generating. Equipment problems, such as leaking feedwater heaters or turbine seals, can also manifest themselves as changes in the unit's heat rates. Fuel quality changes, such as heat content, also affect unit efficiency.

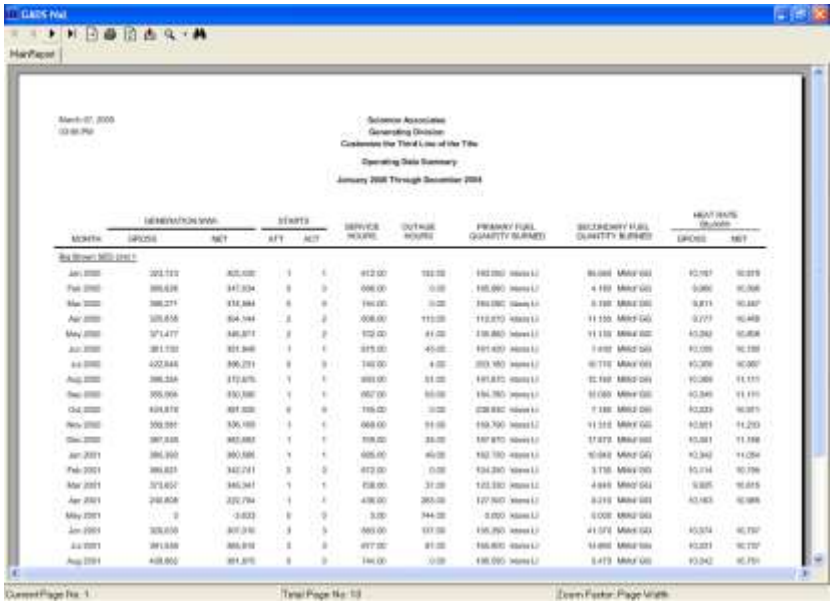

Figure 53. Operating Data Summary Report – Month by Unit

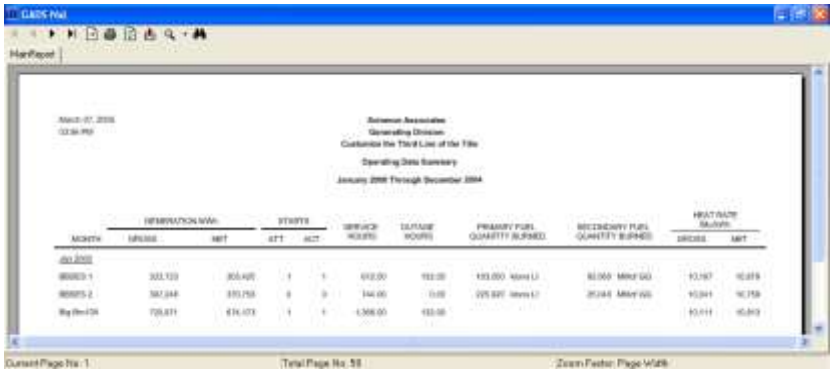

Figure 54. Operating Data Summary Report – Unit by Month

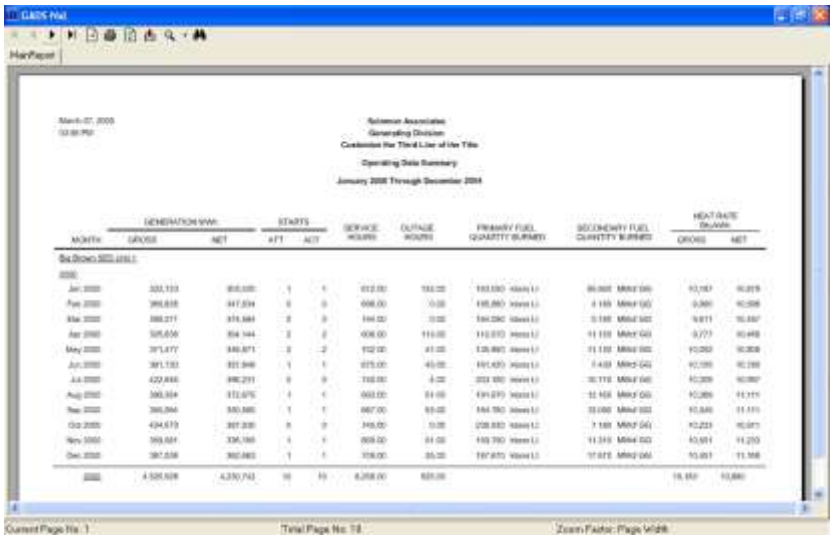

Figure 55. Operating Data Summary Annual Report

This report includes:

- Unit name
- Month
- Gross generation
- Net generation
- Attempted starts
- Actual starts
- Service hours
- Outage hours
- Primary fuel quantity burned
- Secondary fuel quantity burned
- Gross heat rate (Btu/kWh)
- Net heat rate (Btu/kWh)

Performance Statistics: Generating Indexes

The statistics in the Generating Indexes report can be sorted and displayed in three different ways:

- Each month by unit
- Each unit by month
- Annual report

The data displayed in this report is based on the GADS Performance record data.

The Generating Indexes and the Performance Measures reports together provide an excellent overall view of each generating unit's performance.

Trends in the Performance Measures report statistics can sometimes be explained by analyzing the trends on the Operating Data Summary.

For example, if a unit's EAF is increasing, it may simply be that the unit is not running as much as it has historically (less generation or lower number of service hours). A unit that is running less is less likely to fail.

Increasing the number of starts (either attempted or actual) can have an adverse impact on the equivalent forced outage rate (EFOR) if the unit was originally designed for baseload operation. Relationships between unit starts, unit reliability, and costs are very significant. This is especially true if the unit's operational requirements have changed since the unit was originally designed. Measurements such as Service Hours Per Start can also be an indicator of the bases for changes in unit reliability.

Trends in Gross or Net Output Factor can have a direct correlation to unit reliability. The Output Factor is the average load at which the unit runs, and is a direct measurement of how hard the unit is being operated. Units that have high or upward-trending output factors might experience increasing unplanned outages and deratings.

The number of starts, starting reliability, and service hours per start can be used to track unit operation in response to changes in system demand or the market.

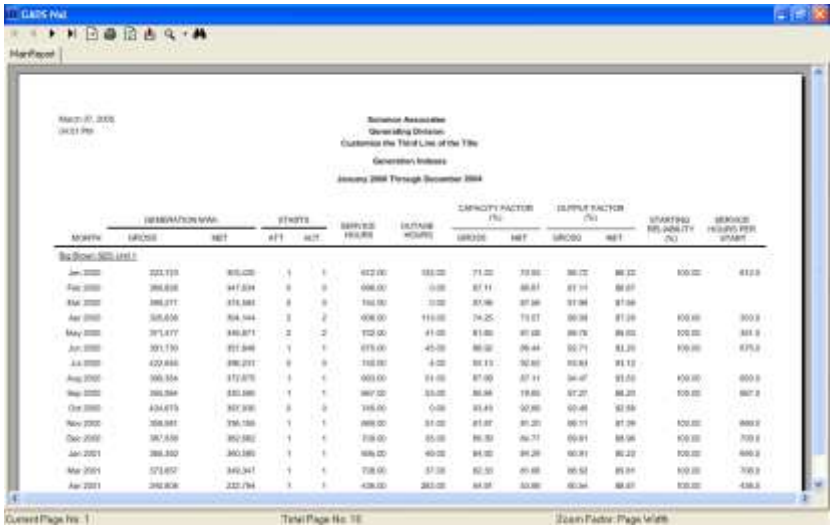

Figure 56. Generation Indexes – Month by Unit

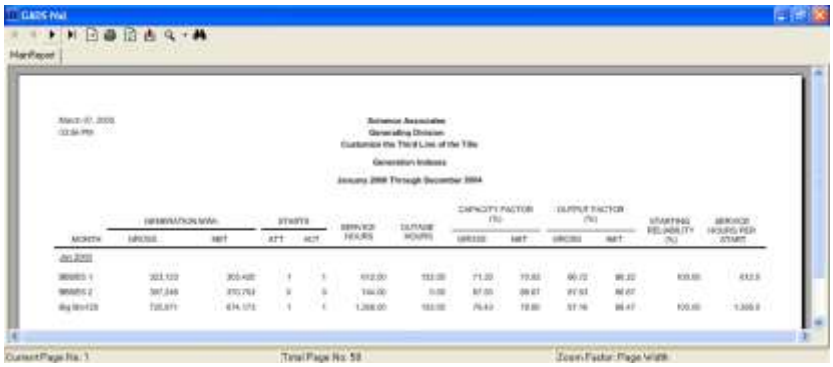

Figure 57. Generation Indexes – Unit by Month

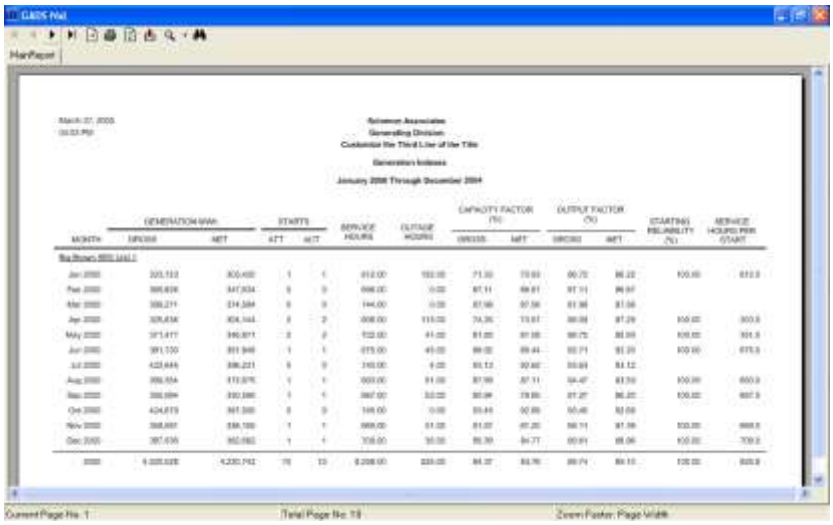

Figure 58. Generation Indexes Annual Report

This report includes:

- Unit name
- Month
- Gross generation
- Net generation
- Attempted starts
- Actual starts
- Service hours
- Outage hours
- Gross capacity factor
- Net capacity factor
- Gross output factor
- Net output factor
- Starting reliability
- Service hours per start

Performance Statistics: Demand-Related Statistics (EFORd and FORd)

This report not only generates the output display, but also populates the EFORdTotal table with data on which the Demand-related Statistics report is based.

Running this report for all units for the last 12 months not only generates the report, but also populates the EFORdTotal table with the statistics and supporting data for the same units over the same time period—one record for each unit for the entire time period selected.

The EFORdTotal table is not populated during the production processing, but only by the running of this report, since this report provides confirmation that the data is correct and that the calculated EFORd and FORd values are as expected—both for the individual months and for the period calculated values. If you chose to include a group in the report, the group values are also created in the tables.

As each report is generated, the data and calculated statistics are added to the EFORdTotal table. Existing table records are not deleted, and are only replaced if the same time period is re-run. This allows you to maintain a historical set of records showing how the EFORd and FORd have changed over time.

This feature was added to provide the various ISOs with EFORd data for calculating UCAP/ICAP values. The group and period EFORd values are calculated using the ISO-NE and NYISO methodology.

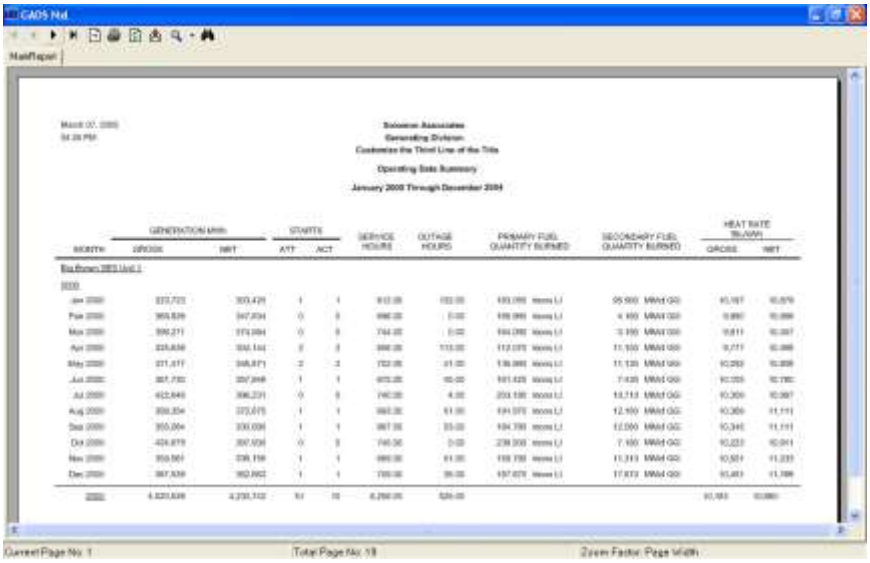

Figure 59. Operating Data Summary Report, Demand-Related Statistics

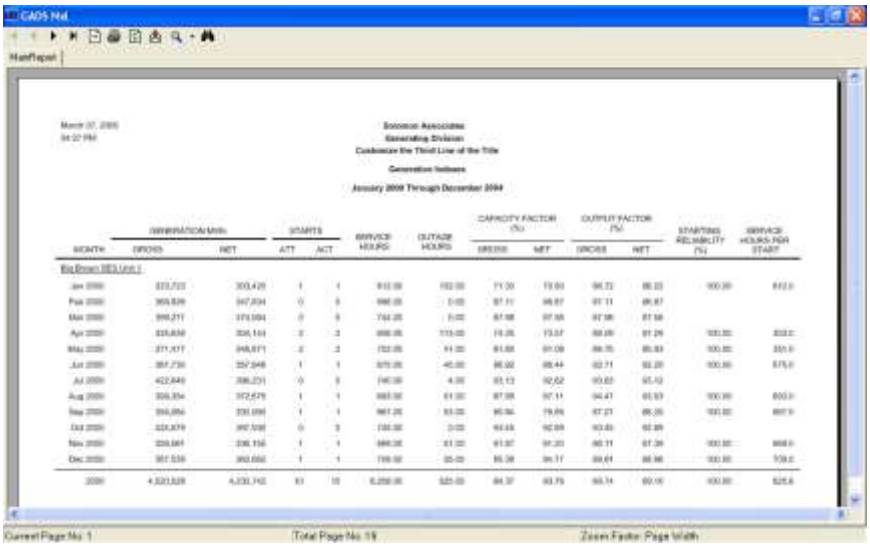

Figure 60. Operating Data Summary Report, Demand-Related Statistics (Year)

This report includes:

- Unit name
- Month
- Attempted starts
- Actual starts
- Service hours
- Forced outage hours
- Number of forced outages
- Reserve shutdown hours
- Number of reserve shutdowns
- EFORd
- FORd

EFORdTotal

Field	Type	Description
UnitShortName	Character	An abbreviated form of the unit's name
UnitName	Character	Unit's or Group's name
UtilityUnitCode	Character	Unit's NERC-assigned Utility Unit Code (6 characters) – Group's program-generated Utility Unit Code
PeriodStart	DateTime	Beginning of period date/time
PeriodEnd	DateTime	End of period date/time
SF	Numeric	Startup Failure Hours (SF)
U1	Numeric	Unplanned (Forced) Outage Hours (U1)
U2	Numeric	Unplanned (Forced) Outage Hours (U2)
U3	Numeric	Unplanned (Forced) Outage Hours (U3)
D1	Numeric	Equivalent Unplanned (Forced) Derated Hours (D1)
D2	Numeric	Equivalent Unplanned (Forced) Derated Hours (D2)
D3	Numeric	Equivalent Unplanned (Forced) Derated Hours (D3)
RS	Numeric	Reserve Shutdown Hours
EUFDH_RS	Numeric	Equivalent Unplanned (Forced) Derated Hours During RS
SH	Numeric	Service Hours
AH	Numeric	Available Hours
FOCount	Numeric	Number of forced outage events
RSCount	Numeric	Number of Reserve Shutdown events
ActualStartsCount	Numeric	Count of number of actual starts
AttemptedStartsCount	Numeric	Count of number of attempted starts
AttemptedStarts	Numeric	Number of Attempted Starts
ActualStarts	Numeric	Number of Actual Starts
ServiceHourMethod	Numeric	Used by the program to determine which formula to use for determining service hours
DEFOR	Numeric	Demand EFOR (EFORd)
DFOR	Numeric	Demand FOR (FORd)
FL_Numerator	Numeric	EFORd formula numerator
FL_Denominator	Numeric	EFORd formula denominator
FL_FORdNumerator	Numeric	FORd formula numerator

Equipment Cause Code Groups

These reports include the various granularities calculated during the standard production processing. Shown on the form in Figure 61, only Monthly, Yearly (Annual), and Peak Periods are enabled. These are the only granularities that have been calculated during the standard production processing.

If you wish to add Quarterly reports, you need to use the **Analysis Admin Console** to add Quarterly granularity to the appropriate group(s). After the calculations are re-run, Quarterly be listed as available for reports.

Calculating stores the calculated results for all selected granularities in the database tables; therefore, running reports is simply a matter of extracting the previously calculated statistics and data from the database tables. This saves time when running reports for monthly departmental reporting, which typically requires a mix of monthly, yearly and peak period reports.

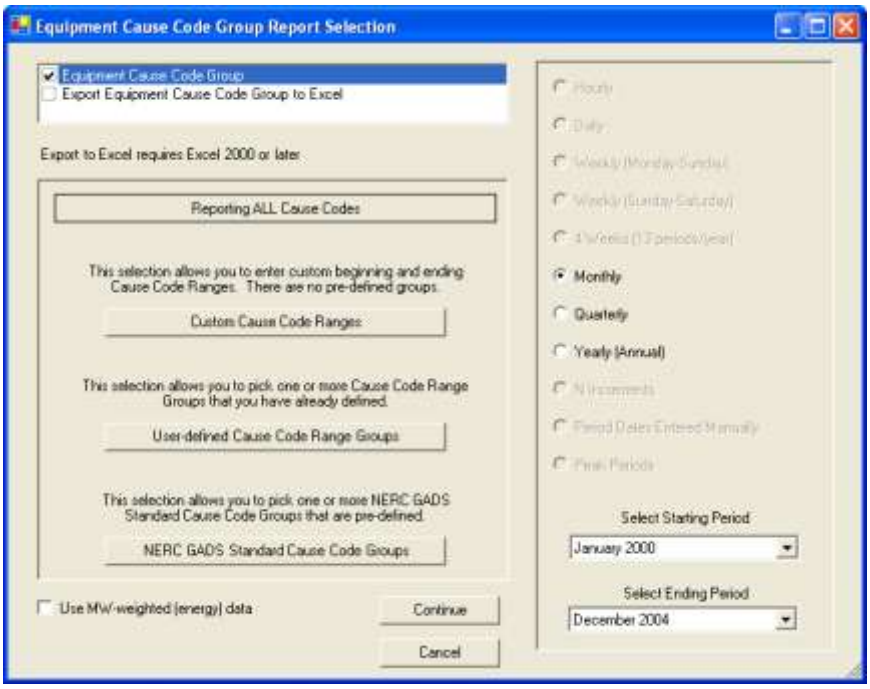

Figure 61. Select Equipment Cause Code Group

This report displays five calculated factors and rates for each of selected equipment group.

The equivalent forced outage rates (EFOR) calculated on this report are different from those calculated by NERC.

Below is the method described by NERC:

Major Equipment Group Calculations

$$Total\,Unit\ EFOR = \frac{FOH + EFDH}{SH + FOH + EFDHRS} \times 100\%$$

$$EFOR\ \ for\ Steam\,Turbines = \frac{All\ Steam\,Turbine\text{-}Related\ \ FO + Equivalent\ \ Forced\ \ Derating\ \ Durations}{Expected\ \ Mission\,Hours} \times 100\%$$

where: durations are calculated from all cause codes related to the major equipment group.

The Expected Mission Hours is the sum of

1. the Unit-Year Average Service Hours,
2. the FOH due to the major equipment group, and
3. the Equivalent Forced Derated Hours During Reserve Shutdowns when the major equipment group was the cause of the derating.

However, using the NERC method, the EFOR values for the groups are not intuitive since the parts (the individual group EFORs) do not add up to the sum of the parts (the unit total EFOR)

The GADS Open Source Analysis & Reporting software does not calculate the group EFOR using the NERC method. Specifically, the forced outage hours, the service hours, and the equivalent unplanned (forced) derated hours during reserve shutdowns for the entire unit—not just the specific equipment group—are used in the denominator (i.e., the Expected Mission Hours by the NERC definition). This means that summing the EFOR for each cause code group now gives you the total for the unit.

For example, assume that the unit EFOR is 5% for the month, and that there are three equipment groups which, combined, cover all of the equipment in the unit such as: (1) boiler, (2) turbine/generator, and (3) rest of the unit (i.e., everything else).

The boiler EFOR, the turbine/generator EFOR, and the rest-of-the-unit EFOR numerical values would add up to the unit's EFOR of 5%, because the only thing in the denominator is period hours.

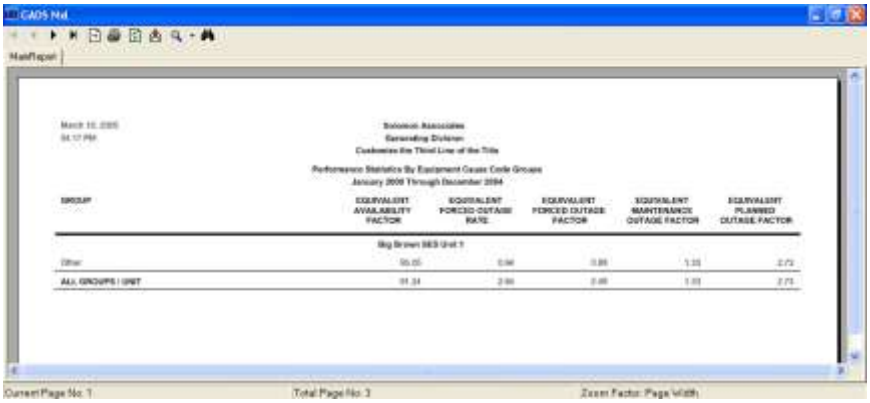

Figure 62. Performance Statistics by Equipment Cause Code Group Report

This report includes:

- Unit name
- Group
- Equivalent availability factor
- Equivalent forced outage rate
- Equivalent forced outage factor
- Equivalent maintenance outage factor
- Equivalent planned outage factor

Custom Calculations

Analysis & Reporting performs standard calculations for the selected granularities for all historical periods. The granularities are established for each group using the **Analysis & Reporting Admin Console**. The group granularity selections are assigned to each of the units that make up that group.

For example, Dallas Unit 1, a gas-fired fossil steam unit, is assigned to both the fossil steam group and the gas-fired group. The fossil steam group needs reports for both monthly and yearly granularities. The gas-fired group needs daily and monthly granularities. Since Dallas Unit 1 is assigned to both groups, when the calculations are run, daily, monthly, and yearly calculations are run on its data. All three granularities' factors and rates for Dallas Unit 1 are stored in the database tables for quick and easy reporting.

There may be occasions, however, that require calculating a granularity for a period that is not a part of the standard processing; such occasions require using the Custom Calculation form. This form allows you to select one or more units, a granularity, and a period range, and the software calculates statistics based on your selections. The results are stored in the database tables and are available for reporting using the standard reporting methods discussed in this user manual.

The only difference is that the new granularity does not become a part of the regular standard calculations; rather, it is a "one-time" process that is manually initiated.

You will note in Figure 63 that Monthly and Yearly (Annual) are disabled. Those results are already calculated and stored in the database tables, so all you need to do is to run the reports; no custom calculations are needed.

After making the necessary selections, click **Continue** to begin the calculations.

To cancel the Custom Calculations, click **Cancel**.

During the calculations, the processing status is displayed above **Cancel** and **Continue**. It displays each unit as it is being calculated and then displays a message indicating the calculations are complete.

When the calculations are complete, simply select Generate Reports from the **Main** menu, and use the standard methods to create the required reports. The only difference is that there is no pre-defined group; therefore, you must choose the individual units to create a custom group for this granularity.

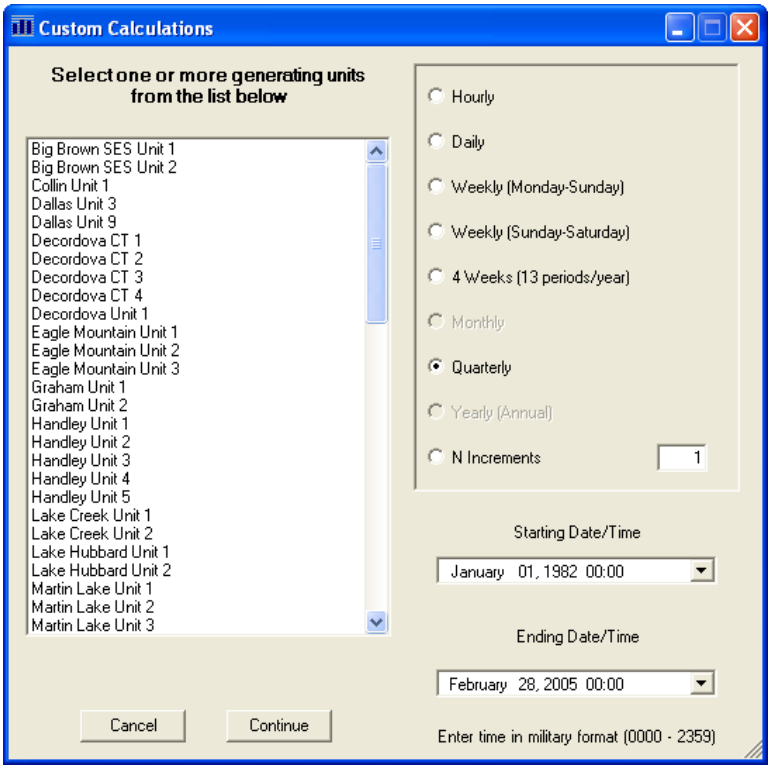

Figure 63. Custom Calculation Dialog

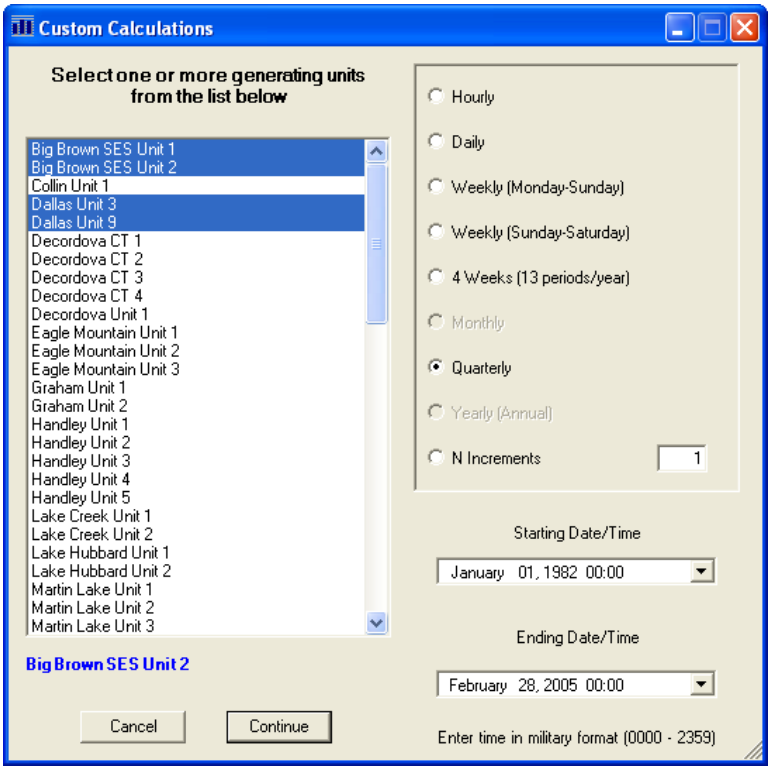

Figure 64. Custom Calculation Dialog Example

Unit/Group Selection

After clicking **Continue** on any of the report forms, you will be taken to the form shown in Figure 65. Select the units and/or groups to include in the report, as well as optional items to be displayed on the report itself.

The name of the report being generated is displayed at the top of the Unit/Group Selection form. As shown in Figure 65, the report being processed is Deratings by Equipment Cause Code.

For some of the reports, you can change the sorting of the displayed data. In most cases, the sorting will be applied only to reports where sorting can be actually done, such as event listings.

When this form is displayed the software "focuses" on the right panel, used to select the standard groups. In this panel, choose first whether to report the Group Only or both the Units & Group. If you choose Units & Group, the units are listed and the group is shown as a summary page. The group pages appear in the report, sorted alphabetically by the unit and group names.

After you have chosen either **Group Only** or **Units & Group**, select one or more groups from the list. If you select more than one group, the software will generate the selected report for every group selected in a back-to-back process.

For example, if the group name is "Big Bear," and the units are named "Big Bear 1" and "Big Bear 2," the "Big Bear" group page will be listed first. If the group name is changed to "Big Bear Plant," the group will be the last pages in the report. This is a "feature" of Crystal Reports, and we are unable to easily "code around it."

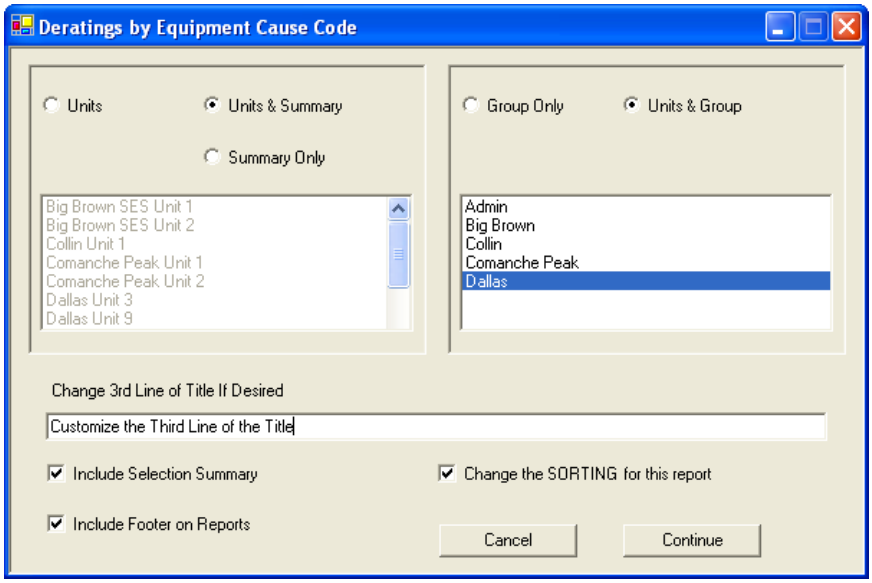

Figure 65. Unit Selection Dialog

If you want to pick your own custom group of units, click anywhere on the left panel to change the focus. The unit list is now enabled, allowing you to select one or more units for the report (refer to Figure 66). The three choices are Units (units only; no group page), Units & Summary (individual units and a summary page), or Summary Only (group page only; no unit pages). After you have chosen one of the three options, select the units to be included in the report. You can select more than one item in the list by holding down the CTRL key, while clicking the desired items

using the left mouse button. You can select a range of items by selecting the first unit in the range, holding down the SHIFT key, and selecting the last unit in the range.

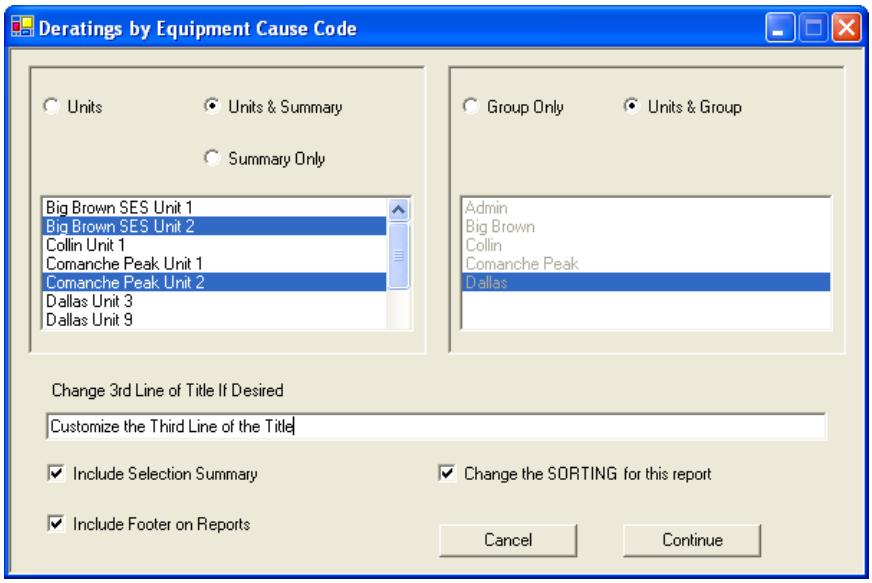

Figure 66. Unit Selection Example

On these forms, the following options are available for the selected report:

- **Change 3rd Line of Title If Desired** – in the **Admin Console,** you had the option to enter three title lines to customize the top of each report. Typically, these title lines include your company's name, the division that is responsible for the GADS data, and the group that is generating the reports; what you decide to use is up to you. You can, however, change the third line for this specific report by entering the new third line here. If left blank, the default third line will be used.
- **Include Selection Summary** – on the last page of each report, the software can list a summary of the selection criteria and assumptions used to create the report. Check this option to include the Selection Summary on the last page.
- **Include Footer on Reports** – in the **Admin Console** you had the option to enter standardized text for the footer on each report page. Typically, the text addresses the confidentiality of the report or who to contact if the reader has any questions. The text you use is up to you. Check this option if you want the footer text displayed on each report page.
- **Change the SORTING for this report** – on some reports you can customize the order in which data is displayed in the report. Check this option if you want to change the display order.

If you have checked the **Change the SORTING for this report**, after you click **Continue** the **Sort Order** form (Figure 67) appears, allowing you to designate how the report data will be displayed.

Figure 67. Sort Order Filters

On the form, designate the sort order and whether that field is sorted ascending or descending. When you are finished with the form, click **OK** to enable the sorting, or **Cancel** to revert back to the report's default sort.

Performance Indexes and Equations

General Information

This section discusses the relationships among the performance indexes calculated from the event and performance data. The basis for these relationships is IEEE Standard 762 "*Definitions for Use in Reporting Electric Generating Unit Reliability, Availability and Productivity*."

Summary of Various Time and Energy Factors Used by Indexes

The following sections describe performance indexes used to measure the performance of generating units. The sections are divided into:

- Unweighted (time-based) methods for calculating single unit statistics
- Unweighted (time-based) methods for pooled (group) unit statistics
- Weighted (energy-based) methods for pooling (group) unit statistics
- Weighted (energy-based) statistics excluding problems outside management control. This fourth section is used Europe and other places in the world for measuring plant personnel productivity

Some Words About Calculations

Please note that when you are calculating a single generating unit's performance statistics, it does not matter whether you use unweighted or weighted statistics. The answer will generally be the same. The real difference between the unweighted and weighted statistics is in pooling (or grouping) a set of generating units. In such cases, a group of units of similar size will show little or no differences, but for a group of units where the range in MW size is very different (greater than 50 MW), the statistics will be very different.

With unweighted statistics, all units are considered equal in outage impact. In the unweighted equations, no MW size is introduced into the equations and the results are based on time; not energy produced (or not produced). In such cases, a 50 MW gas turbine and a 1,000 MW nuclear unit have the same impact of the resulting statistics.

With weighted statistics, the larger MW size unit in the group has more impact on the final statistics than a smaller generating unit, because the MW size of the unit (NMC/GMC) is part of the equation. In such cases, a 1,000 MW nuclear unit would have 20 times impact on the final outcome of the pool or fleet calculation that its 50 MW gas turbine companion would have.

More Words About Data Pooling

To weight an equation, one does not simply take each unit's EFOR, for example, and multiply the EFOR by the NMC, add them u,p and divide by the sum of the NMCs.

Each term in the equation must be multiplied by the NMC, and all the products summed over all the units.

When grouping a fleet of units with dissimilar sizes and/or duty cycles, weighting puts the proper relative weight for each unit's contribution into the fleet's composite indexes.

Using the unweighted equations currently in the IEEE 762 Standard (Section 7), an older, smaller, little-run unit will have just as much weight as a newer, larger, baseload unit. This approach could unrealistically and disproportionately swing the unweighted fleet averages too high (for a very high availability on a small unit) or too low (for a very low availability on a small unit).

The current IEEE 762 Standard's unweighted equations should not be abandoned, however, even for group statistics. There are valid applications for this method, such as evaluating equipment reliability and availability regardless of size.

Weighted calculations, although primarily needed for grouping units' performance indexes, may apply to individual units as well. The effect will be minimal, but over months or years, many units' net maximum capacities (NMC) do change somewhat.

Unweighted (Time-Based) Performance Indexes – Single Unit Calculations

1. Planned Outage Factor (POF)

$$POF = \frac{POH}{PH} \times 100\%$$

2. Unplanned Outage Factor (UOF)

$$UOF = \frac{UOH}{PH} \times 100\%$$

$$UOF = \frac{MOH + FOH}{PH} \times 100\%$$

3. Forced Outage Factor (FOF)

$$FOF = \frac{FOH}{PH} \times 100\%$$

4. Maintenance Outage Factor (MOF)

$$MOF = \frac{MOH}{PH} \times 100\%$$

5. Scheduled Outage Factor (SOF)

$$SOF = \frac{SOH}{PH} \times 100\%$$

$$SOF = \frac{POH + MOH}{PH} \times 100\%$$

6. Unavailability Factor (UF)

$$UF = \frac{UH}{PH} \times 100\%$$

$$UF = \frac{POH + MOH + FOH}{PH} \times 100\%$$

7. Availability Factor (AF)

$$AF = \frac{AH}{PH} \times 100\%$$

$$AF = \frac{SH + RSH + Sync\ Hours + Pumping\ Hours}{PH} \times 100\%$$

8. Service Factor (SF)

$$SF = \frac{SH}{PH} \times 100\%$$

9. Seasonal Derating Factor (SEDF)

$$SEDF = \frac{ESEDH}{PH} \times 100\%$$

10. Unit Derating Factor (UDF)

$$UDF = \frac{EPDH + EUDH}{PH} \times 100\%$$

$$UDF = \frac{EPDH + EMDH + EFDH}{PH} \times 100\%$$

11. Equivalent Unavailability Factor (EUF)

$$EUF = \frac{UOH + POH + EUDH + EPDH}{PH} \times 100\%$$

$$EUF = \frac{FOH + MOH + POH + EFDH + EMDH + EPDH}{PH} \times 100\%$$

12. Equivalent Availability Factor (EAF)

$$EAF = \frac{AH - EPDH - EUDH - ESEDH}{PH} \times 100\%$$

$$EAF = \frac{AH - EPDH - EFDH - EMDH - ESEDH}{PH} \times 100\%$$

13. Gross Capacity Factor (GCF)

$$GCF = \frac{Gross\ Actual\ Generation}{PH \times GMC} \times 100\%$$

NCF calculated using this equation may be negative during a shutdown period; however, the software will not calculate a negative NCF.

14. Net Capacity Factor (NCF)

$$NCF = \frac{Net\ Actual\ Generation}{PH \times NMC} \times 100\%$$

15. Gross Output Factor (GOF)

$$GCF = \frac{Gross\ Actual\ Generation}{SH \times GMC} \times 100\%$$

16. Net Output Factor (NOF)

$$NOF = \frac{Net\ Actual\ Generation}{SH \times NMC} \times 100\%$$

17. Equivalent Maintenance Outage Factor (EMOF)

$$EMOF = \frac{MOH + EMDH}{PH} \times 100\%$$

18. Equivalent Planned Outage Factor (EPOF)

$$EPOF = \frac{POH + EPDH}{PH} \times 100\%$$

19. Equivalent Forced Outage Factor (EFOF)

$$EFOF = \frac{FOH + EFDH}{PH} \times 100\%$$

20. Equivalent Scheduled Outage Factor (ESOF)

$$ESOF = \frac{SOH + ESDH}{PH} \times 100\%$$

$$ESOF = \frac{MOH + POH + EMDH + EPDH}{PH} \times 100\%$$

This EUOF is identical to the Unit Capability Loss Factor except this equation includes all events, including those outside plant management control.

21. Equivalent Unplanned Outage Factor (EUOF)

$$EUOF = \frac{UOH + EUDH}{PH} \times 100\%$$

$$EUOF = \frac{MOH + FOH + EMDH + EFDH}{PH} \times 100\%$$

22. Forced Outage Rate (FOR)

$$FOR = \frac{FOH}{FOH + SH + Sync\ Hours + Pumping\ Hours} \times 100\%$$

23. Forced Outage Rate Demand (FORd)

$$FORd = \frac{FOHd}{FOHd + SH} \times 100\%$$

where

$$FOHd = fx\,FOH$$

$$f = \frac{\left(\frac{1}{r} + \frac{1}{T}\right)}{\left(\frac{1}{r} + \frac{1}{T} + \frac{1}{D}\right)}$$

r = Average Forced outage duration = (FOH)/(# of FO occurrences)
D = Average demand time = (SH)/(# of unit actual starts)
T = Average reserve shutdown time = (RSH)/(# of unit attempted starts)

24. Equivalent Forced Outage Rate (EFOR)

$$EFOR = \frac{FOH + EFDH}{FOH + SH + Sync\ Hours + Pumping\ Hours + EFDHRS} \times 100\%$$

25. Equivalent Forced Outage Rate demand (EFORd)

$$EFORd = \frac{FOHd + EFDHd}{FOHd + SH} \times 100\%$$

where
FOHd = fx FOH
EFDHd = (EFDH – EFDHRS) if reserve shutdown events reported, or
= (fp × EFDH) if no reserve shutdown events reported
(an approximation)

$$fp = \frac{SH}{AH}$$

$$f = \frac{\left(\frac{1}{r} + \frac{1}{T}\right)}{\left(\frac{1}{r} + \frac{1}{T} + \frac{1}{D}\right)}$$

r = Average Forced outage duration = (FOH)/(# of FO occurrences)
D = Average demand time = (SH)/(# of unit actual starts)
T = Average reserve shutdown time = (RSH)/(# of unit attempted starts)

26. Equivalent Planned Outage Rate (EPOR)

$$EPOR = \frac{POH + EPDH}{POH + SH + Sync\ Hours + Pumping\ Hours + EPDHRS} \times 100\%$$

27. Equivalent Maintenance Outage Rate (EMOR)

$$EMOR = \frac{MOH + EMDH}{MOH + SH + Sync\ Hours + Pumping\ Hours + EMDHRS} \times 100\%$$

28. Equivalent Unplanned Outage Rate (EUOR)

$$EUOR = \frac{UOH + EUDH}{UOH + SH + SyncHours + PumpingHours + EUDHRS} \times 100\%$$

$$EUOR = \frac{FOH + EFDH + MOH + EMDH}{FOH + MOH + SH + SyncHrs + PumpHrs + EFDHRS + EMDHRS} \times 100\%$$

29. Average Run Time (ART)

$$ART = \frac{SH}{Actual\ Unit\ Starts} \times 100\%$$

30. Starting Reliability (SR)

$$SR = \frac{Actual\ Unit\ Starts}{Attempted\ Unit\ Starts} \times 100\%$$

31. Mean Service Time to Outage

31a. Mean Service Time to Planned Outage (MSTPO)

$$MSTPO = \frac{Service\ Hours}{Number\ of\ Planned\ Outages\ (occurring\ from\ in\text{-}service\ state\ only)}$$

31b. Mean Service Time to Unplanned Outage (MSTUO)

$$MSTUO = \frac{Service\ Hours}{Number\ of\ Unplanned\ Outages\ (occurring\ from\ in\text{-}service\ state\ only)}$$

31c. Mean Service **Time To Forced Outage (MSTFO)**

$$MSTFO = \frac{Service\ Hours}{Number\ of\ Unplanned\ (Forced)\ Outages\ (occurring\ from\ in\text{-}service\ state\ only)}$$

31d. Mean Service Time to Maintenance Outage (MSTMO)

$$MSTMO = \frac{Service\ Hours}{Number\ of\ Maintenance\ Outages\ (occurring\ from\ in\text{-}service\ state\ only)}$$

32. Mean Outage Duration

32a. Mean Planned Outage Duration (MPOD)

$$MPOD = \frac{Planned\ Outage\ Hours}{Number\ of\ Planned\ Outages\ (occurring\ from\ in\text{-}service\ state\ only)}$$

32b. Mean Unplanned Outage Duration (MUOD)

$$MUOD = \frac{Unplanned\ Outage\ Hours}{Number\ of\ Unplanned\ Outages\ (occurring\ from\ in\text{-}service\ state\ only)}$$

32c. Mean Forced Outage Duration (MFOD)

$$MFOD = \frac{Unplanned\ (Forced)\ Outage\ Hours}{Number\ of\ Unplanned\ (Forced)\ Outages\ (occurring\ from\ in\text{-}service\ state\ only)}$$

32d. Mean Maintenance Outage Duration (MMOD)

$$MMOD = \frac{Maintenance\ Outage\ Hours}{Number\ of\ Maintenance\ Outages\ (occurring\ from\ in\text{-}service\ state\ only)}$$

Unweighted (Time-Based) Performance Indexes – Pooling Unit Calculations

33. Forced Outage Factor (FOF)

$$FOF = \frac{\Sigma\, FOH}{\Sigma\, PH} \times 100\%$$

34. Maintenance Outage Factor (MOF)

$$MOF = \frac{\Sigma\, MOH}{\Sigma\, PH} \times 100\%$$

35. Planned Outage Factor (POF)

$$POF = \frac{\Sigma\, POH}{\Sigma\, PH} \times 100\%$$

36. Unplanned Outage Factor (UOF)

$$UOF = \frac{\Sigma\,(FOH + MOH)}{\Sigma\, PH} \times 100\%$$

37. Scheduled Outage Factor (SOF)

$$SOF = \frac{\Sigma\,(POH + MOH)}{\Sigma\, PH} \times 100\%$$

38. Unavailability Factor (UF)

$$UF = \frac{\Sigma\,(POH + MOH + FOH)}{\Sigma\, PH} \times 100\%$$

39. Availability Factor (AF)

$$AF = \frac{\Sigma\, AH}{\Sigma\, PH} \times 100\%$$

$$AF = \frac{\Sigma\,(SH + RSH + Sync\ Hours + Pumping\ Hours)}{\Sigma\, PH} \times 100\%$$

40. Service Factor (SF)

$$SF = \frac{\Sigma\, SH}{\Sigma\, PH} \times 100\%$$

41. Seasonal Derating Factor (SEDF)

$$SEDF = \frac{\Sigma\, ESEDH}{\Sigma\, PH} \times 100\%$$

42. Unit Derating Factor (UDF)

$$UDF = \frac{\Sigma\,(EUDH + EPDH)}{\Sigma\, PH} \times 100\%$$

$$UDF = \frac{\Sigma\,(EFDH + EMDH + EPDH)}{\Sigma\, PH} \times 100\%$$

43. Equivalent Unavailability Factor (EUF)

$$EUF = \frac{\Sigma\,(POH + UOH + EUDH + EPDH)}{\Sigma\,PH} \times 100\%$$

$$EUF = \frac{\Sigma\,(SOH + FOH + ESDH + EFDH)}{\Sigma\,PH} \times 100\%$$

$$EUF = \frac{\Sigma\,(POH + MOH + FOH + EFDH + EMDH + EPDH)}{\Sigma\,PH} \times 100\%$$

44. Equivalent Availability Factor (EAF)

$$EAF = \frac{\Sigma\,(AH - EUDH - EPDH - ESEDH)}{\Sigma\,PH} \times 100\%$$

$$EAF = \frac{\Sigma\,(AH - EFDH - EMDH - EPDH - ESEDH)}{\Sigma\,PH} \times 100\%$$

Special energy-weighted equations are not necessary for "energy terms" (GCF, NCF, GOF, NOF), because these factors are inherently energy-weighted. These equations are the same as 13 – 16. But when calculating for a group of units (or a unit that has a varying capacity value over time), do not simply average these factors. Follow the equations.

45. Gross Capacity Factor (GCF)

$$GCF = \frac{\Sigma\,(Gross\ Actual\ Generation)}{\Sigma\,(GMC \times PH)} \times 100\%$$

46. Net Capacity Factor (NCF)

$$NCF = \frac{\Sigma\,(Net\ Actual\ Generation)}{\Sigma\,(NMC \times PH)} \times 100\%$$

47. Gross Output Factor (GOF)

$$GOF = \frac{\Sigma\,(Gross\ Actual\ Generation)}{\Sigma\,(GMC \times SH)} \times 100\%$$

48. Net Output Factor (NOF)

$$NOF = \frac{\Sigma\,(Net\ Actual\ Generation)}{\Sigma\,(NMC \times SH)} \times 100\%$$

49. Equivalent Maintenance Outage Factor (EMOF)

$$EMOF = \frac{\Sigma\,(MOH + EMDH)}{\Sigma\,PH} \times 100\%$$

50. Equivalent Planned Outage Factor (EPOF)

$$EPOF = \frac{\Sigma\,(POH + EPDH)}{\Sigma\,PH} \times 100\%$$

51. Equivalent Forced Outage Factor (EFOF)

$$EFOF = \frac{\Sigma\,(FOH + EFDH)}{\Sigma\,PH} \times 100\%$$

52. Equivalent Scheduled Outage Factor (ESOF)

$$ESOF = \frac{\Sigma\,(SOH + ESDH)}{\Sigma\,PH} \times 100\%$$

$$ESOF = \frac{\Sigma\,(MOH + POH + EMDH + EPDH)}{\Sigma\,PH} \times 100\%$$

53. Equivalent Unplanned Outage Factor (EUOF)

$$EUOF = \frac{\Sigma\,(UOH + EUDH)}{\Sigma\,PH} \times 100\%$$

$$EUOF = \frac{\Sigma\,(MOH + FOH + EMDH + EFDH)}{\Sigma\,PH} \times 100\%$$

54. Forced Outage Rate (FOR)

$$FOR = \frac{\Sigma\,FOH}{\Sigma\,(FOH + SH + Sync\ Hours + Pumping\ Hours)} \times 100\%$$

55. Forced Outage Rate demand (FORd)

$$FORd = \frac{\Sigma\,FOHd}{\Sigma\,(FOHd + SH)} \times 100\%$$

where

$$FOHd = fx\,FOH$$

$$f = \frac{\left(\frac{1}{r} + \frac{1}{T}\right)}{\left(\frac{1}{r} + \frac{1}{T} + \frac{1}{D}\right)}$$

r = Average Forced outage duration = (FOH)/(# of FO occurrences)
D = Average demand time = (SH)/(# of unit actual starts)
T = Average reserve shutdown time = (RSH)/(# of unit attempted starts)

56. Equivalent Forced Outage Rate (EFOR)

$$EFOR = \frac{\Sigma\,(FOH + EFDH)}{\Sigma\,(FOH + SH + Sync\ Hours + Pumping\ Hours + EFDHRS)} \times 100\%$$

57. Equivalent Forced Outage Rate demand (EFORd)

$$EFORd = \frac{\Sigma\,(FOHd + EFDHd)}{\Sigma\,(FOHd + SH)} \times 100\%$$

where
FOHd = fx FOH
EFDHd = (EFDH – EFDHRS) if reserve shutdown events reported, or
= (fp × EFDH) if no reserve shutdown events reported
(an approximation)

$$fp = \frac{SH}{AH}$$

$$f = \frac{\left(\frac{1}{r} + \frac{1}{T}\right)}{\left(\frac{1}{r} + \frac{1}{T} + \frac{1}{D}\right)}$$

r = Average Forced outage duration = (FOH)/(# of FO occurrences)
D = Average demand time = (SH)/(# of unit actual starts)
T = Average reserve shutdown time = (RSH)/(# of unit attempted starts)

58. Equivalent Planned Outage Rate (EPOR)

$$EPOR = \frac{\Sigma\,(POH + EPDH)}{\Sigma\,(POH + SH + Sync\ Hours + Pumping\ Hours + EPDHRS)} \times 100\%$$

59. Equivalent Maintenance Outage Rate (EMOR)

$$EMOR = \frac{\Sigma\,(MOH + EMDH)}{\Sigma\,(MOH + SH + Sync\ Hours + Pumping\ Hours + EMDHRS)} \times 100\%$$

60. Equivalent Unplanned Outage Rate (EUOR)

$$EUOR = \frac{UOH + EUDH}{UOH + SH + SyncHours + PumpingHours + EUDHRS} \times 100\%$$

$$EUOR = \frac{FOH + EFDH + MOH + EMDH}{FOH + MOH + SH + SyncHrs + PumpHrs + EFDHRS + EMDHRS} \times 100\%$$

Weighted (Energy-Based) Performance Indexes – Pooling Unit Calculations

61. Weighted Forced Outage Factor (WFOF)

$$WFOF = \frac{\Sigma\,(FOH \times NMC\,)}{\Sigma\,(PH \times NMC)} \times 100\%$$

62. Weighted Maintenance Outage Factor (WMOF)

$$WMOF = \frac{\Sigma\,(MOH \times NMC\,)}{\Sigma\,(PH \times NMC)} \times 100\%$$

63. Weighted Planned Outage Factor (WPOF)

$$WPOF = \frac{\Sigma\,(POH \times NMC\,)}{\Sigma\,(PH \times NMC)} \times 100\%$$

64. Weighted Unplanned Outage Factor(WUOF)

$$WUOF = \frac{\Sigma\,(UOH \times NMC\,)}{\Sigma\,(PH \times NMC)} \times 100\%$$

$$WUOF = \frac{\Sigma\,[(FOH + MOH\,) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

65. Weighted Scheduled Outage Factor (WSOF)

$$WSOF = \frac{\Sigma\,(SOH \times NMC\,)}{\Sigma\,(PH \times NMC)} \times 100\%$$

$$WSOF = \frac{\Sigma\,[(POH + MOH\,) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

66. Weighted Unavailability Factor (WUF)

$$WUF = \frac{\Sigma\,[(POH + MOH + FOH\,) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

67. Weighted Availability Factor (WAF)

$$WAF = \frac{\Sigma\,(AH \times NMC\,)}{\Sigma\,(PH \times NMC)} \times 100\%$$

68. Weighted Service Factor (WSF)

$$WSF = \frac{\Sigma\,(SH \times NMC\,)}{\Sigma\,(PH \times NMC)} \times 100\%$$

69. Weighted Seasonal Derating Factor (WSEDF)

$$WSEDF = \frac{\Sigma\,(ESEDH \times NMC\,)}{\Sigma\,(PH \times NMC)} \times 100\%$$

70. Weighted Unit Derating Factor (WUDF)

$$WUDF = \frac{\Sigma\,[(EUDH + EPDH) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

$$WUDF = \frac{\Sigma\,[(EFDH + EMDH + EPDH) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

71. Weighted Equivalent Unavailability Factor (WEUF)

$$WEUF = \frac{\Sigma\,[(POH + UOH + EUDH + EPDH) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

$$WEUF = \frac{\Sigma\,[(SOH + UOH + EUDH + EPDH) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

$$WEUF = \frac{\Sigma\,[(POH + MOH + FOH + EFDH + EMDH + EPDH) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

72. Weighted Equivalent Availability Factor (WEAF)

$$WEAF = \frac{\Sigma\,[(AH - EUDH - EPDH - ESEDH) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

$$WEAF = \frac{\Sigma\,[(AH - EFDH - EMDH - EPDH - ESEDH) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

Special energy-weighted equations are not necessary for "energy terms" (GCF, NCF, GOF, NOF), because these factors are inherently energy-weighted. These equations are the same as 13–16. But when calculating for a group of units (or a unit that has a varying capacity value over time), do not simply average these factors. Follow the equations.

73. Gross Capacity Factor (GCF)

$$GCF = \frac{\Sigma\,(Gross\ Actual\ Generation)}{\Sigma\,(GMC \times PH)} \times 100\%$$

74. Net Capacity Factor (NCF)

$$NCF = \frac{\Sigma\,(Net\ Actual\ Generation)}{\Sigma\,(NMC \times PH)} \times 100\%$$

75. Gross Output Factor (GOF)

$$GOF = \frac{\Sigma\,(Gross\ Actual\ Generation)}{\Sigma\,(GMC \times SH)} \times 100\%$$

76. Net Output Factor (NOF)

$$NOF = \frac{\Sigma\,(Net\ Actual\ Generation)}{\Sigma\,(NMC \times SH)} \times 100\%$$

77. Weighted Equivalent Maintenance Outage Factor (WEMOF)

$$WEMOF = \frac{\Sigma\,[(MOH + EMDH) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

78. Weighted Equivalent Planned Outage Factor (WEPOF)

$$WEPOF = \frac{\Sigma\,[(POH + EPDH) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

79. Weighted Equivalent Forced Outage Factor (WEFOF)

$$WEFOF = \frac{\Sigma\,[(FOH + EFDH) \times NMC\,]}{\Sigma\,(PH \times NMC)} \times 100\%$$

80. Weighted Equivalent Scheduled Outage Factor (WESOF)

$$WESOF = \frac{\Sigma\,[(SOH + ESDH) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

$$WESOF = \frac{\Sigma\,[(MOH + POH + EMDH + EPDH\,) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

81. Weighted Equivalent Unplanned Outage Factor (WEUOF)

$$WEUOF = \frac{\Sigma\,[(UOH + EUDH) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

$$WEUOF = \frac{\Sigma\,[(MOH + FOH + EFDH + EMDH\,) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

NOTE: This is identical to the Weighted Unit Capability Loss Factor except this equation includes all events, including those outside plant management control.

82. Weighted Forced Outage Rate (WFOR)

$$WFOR = \frac{\Sigma\,(FOH \times NMC)}{\Sigma\,[(FOH + SH + Sync\ Hours + Pumping\ Hours) \times NMC]} \times 100\%$$

83. Weighted Forced Outage Rate demand (WFORd)

$$WFORd = \frac{\Sigma\,(FOHd \times NMC)}{\Sigma\,[(FOHd + SH) \times NMC]} \times 100\%$$

where
FOHd = fx FOH

$$f = \frac{\left(\frac{1}{r} + \frac{1}{T}\right)}{\left(\frac{1}{r} + \frac{1}{T} + \frac{1}{D}\right)}$$

r = Average Forced outage duration = (FOH)/(# of FO occurrences)
D = Average demand time = (SH)/(# of unit actual starts)
T = Average reserve shutdown time = (RSH)/(# of unit attempted starts)

84. Weighted Equivalent Forced Outage Rate (WEFOR)

$$EFOR = \frac{\Sigma[(FOH + EFDH) \times NMC]}{\Sigma\,[(FOH + SH + Sync\ Hours + Pumping\ Hours + EFDHRS)] \times NMC} \times 100\%$$

85. Weighted Equivalent Forced Outage Rate demand (WEFORd)

$$WEFORd = \frac{\Sigma\,[(FOHd + EFDHd) \times NMC]}{\Sigma\,[(FOHd + SH) \times NMC]} \times 100\%$$

where
FOHd = fx FOH
EFDHd = (EFDH – EFDHRS) if reserve shutdown events reported, or
= (fp × EFDH) if no reserve shutdown events reported (an approximation)

$$fp = \frac{SH}{AH}$$

$$f = \frac{\left(\frac{1}{r} + \frac{1}{T}\right)}{\left(\frac{1}{r} + \frac{1}{T} + \frac{1}{D}\right)}$$

r = Average Forced outage duration = (FOH)/(# of FO occurrences)
D = Average demand time = (SH)/(# of unit actual starts)
T = Average reserve shutdown time = (RSH)/(# of unit attempted starts)

86. Weighted Equivalent Planned Outage Rate (WEPOR)

$$WEPOR = \frac{\Sigma[(POH + EPDH) \times NMC]}{\Sigma\,[(POH + SH + Sync\ Hrs + Pump\ Hrs + EPDHRS) \times NMC]} \times 100\%$$

87. Weighted Equivalent Maintenance Outage Rate (WEMOR)

$$WEMOR = \frac{\Sigma[(MOH + EMDH) \times NMC]}{\Sigma\,[(MOH + SH + Sync\ Hrs + Pump\ Hrs + EMDHRS) \times NMC]} \times 100\%$$

88. Weighted Equivalent Unplanned Outage Rate (WEUOR)

$$WEUOR = \frac{\Sigma[(UOH + EUDH) \times NMC]}{\Sigma\,[(UOH + SH + Sync\ Hrs + Pump\ Hrs + EUDHRS) \times NMC]} \times 100\%$$

Weighted (Energy-Based) Performance Indexes – Outside Management Control Unit Calculations

89. Weighted Unit Capability Factor (WUCF)

$$WUCF = \frac{\Sigma\,[(AH - EUDH - EPDH - ESEDH) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

$$WUCF = \frac{\Sigma\,[(AH - EFDH - EMDH - EPDH - ESEDH) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

NOTE: This is identical to the Weighted Equivalent Availability Factor except this equation excludes all events outside plant management control.

90. Weighted Unit Capability Loss Factor (WUCLF)

$$WUCLF = \frac{\Sigma\,[(UOH + EUDH) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

$$WUCLF = \frac{\Sigma\,[(MOH + FOH + EFDH + EMDH) \times NMC]}{\Sigma\,(PH \times NMC)} \times 100\%$$

NOTE: This is identical to the Weighted Equivalent Unplanned Outage Factor except this equation excludes all events outside plant management control.

Custom Reporting

The GADS Open Source Analysis & Reporting creates six tables in the database that contain the output results of the calculations. With these tables, you can create your own custom reports through any application that can retrieve data from Oracle, Microsoft SQL Server, or Microsoft Access.

The fields in each of the six tables are identified below:

Event Hours

Field	Type	Description
UnitShortName	**Character**	**An abbreviated form of the unit's name**
TL_DateTime	**DateTime**	**End-of-period date/time**
PO	**Numeric**	**Planned Outage Hours (PO)**
PO_SE	**Numeric**	**Scheduled Outage Extension Hours of Planned Outages (SE)**
MO	**Numeric**	**Maintenance Outage Hours (MO)**
MO_SE	**Numeric**	**Scheduled Outage Extension Hours of Maintenance Outages (SE)**
SF	**Numeric**	**Startup Failure Hours (SF)**
U1	**Numeric**	**Unplanned (Forced) Outage Hours (U1)**
U2	**Numeric**	**Unplanned (Forced) Outage Hours (U2)**
U3	**Numeric**	**Unplanned (Forced) Outage Hours (U3)**
D1	**Numeric**	**Equivalent Unplanned (Forced) Derated Hours (D1)**
D2	**Numeric**	**Equivalent Unplanned (Forced) Derated Hours (D2)**
D3	**Numeric**	**Equivalent Unplanned (Forced) Derated Hours (D3)**
D4	**Numeric**	**Equivalent Maintenance Derated Hours (D4)**
D4_DE	**Numeric**	**Extension of Maintenance Derating Equivalent Hours (DE)**
PD	**Numeric**	**Equivalent Planned Derated Hours (PD)**
PD_DE	**Numeric**	**Extension of Planned Derating Equivalent Hours (DE)**
RS	**Numeric**	**Reserve Shutdown Hours**
NC	**Numeric**	**Noncurtailing Hours**
EUFDH_RS	**Numeric**	**Equivalent Unplanned (Forced) Derated Hours During RS**
EPDH_RS	**Numeric**	**Equivalent Planned Derated Hours During RS**
EMDH_RS	**Numeric**	**Equivalent Maintenance Derated Hours During RS**
SH	**Numeric**	**Service Hours**
PH	**Numeric**	**Period Hours**
ESEDH	**Numeric**	**Equivalent Seasonal Derated Hours**
AH	**Numeric**	**Available Hours**
POF	**Numeric**	**Planned Outage Factor (%)**
UOF	**Numeric**	**Unplanned Outage Factor (%)**
FOF	**Numeric**	**Forced Outage Factor (%)**
MOF	**Numeric**	**Maintenance Outage Factor (%)**
SOF	**Numeric**	**Scheduled Outage Factor (%)**

Event Hours

Field	Type	Description
UF	Numeric	Unavailability Factor (%)
AF	Numeric	Availability Factor (%)
SEF	Numeric	Service Factor (%)
SDF	Numeric	Seasonal Derating Factor (%)
UDF	Numeric	Unit Derating Factor (%)
EUF	Numeric	Equivalent Unavailability Factor (%)
EAF	Numeric	Equivalent Availability Factor (%)
EMOF	Numeric	Equivalent Maintenance Outage Factor (%)
EPOF	Numeric	Equivalent Planned Outage Factor (%)
EFOF	Numeric	Equivalent Forced Outage Factor (%)
ESOF	Numeric	Equivalent Scheduled Outage Factor (%)
EUOF	Numeric	Equivalent Unplanned Outage Factor (%)
EPOR	Numeric	Equivalent Planned Outage Rate (%)
EMOR	Numeric	Equivalent Maintenance Outage Rate (%)
EUOR	Numeric	Equivalent Unplanned Outage Rate (%)
FORate	Numeric	Forced Outage Rate (%)
EFOR	Numeric	Equivalent Forced Outage Rate (%)
E_PO	Numeric	Planned Outage Hours (PO) in MWh
E_PO_SE	Numeric	Scheduled Outage Extension Hours of Planned Outages (SE) in MWh
E_MO	Numeric	Maintenance Outage Hours (MO) in MWh
E_MO_SE	Numeric	Scheduled Outage Extension Hours of Maintenance Outages (SE) in MWh
E_SF	Numeric	Startup Failure Hours (SF) in MWh
E_U1	Numeric	Unplanned (Forced) Outage Hours (U1) in MWh
E_U2	Numeric	Unplanned (Forced) Outage Hours (U2) in MWh
E_U3	Numeric	Unplanned (Forced) Outage Hours (U3) in MWh
E_D1	Numeric	Equivalent Unplanned (Forced) Derated Hours (D1) in MWh
E_D2	Numeric	Equivalent Unplanned (Forced) Derated Hours (D2) in MWh
E_D3	Numeric	Equivalent Unplanned (Forced) Derated Hours (D3) in MWh
E_D4	Numeric	Equivalent Maintenance Derated Hours (D4) in MWh
E_D4_DE	Numeric	Extension of Maintenance Derating Equivalent Hours (DE) in MWh
E_PD	Numeric	Equivalent Planned Derated Hours (PD) in MWh
E_PD_DE	Numeric	Extension of Planned Derating Equivalent Hours (DE) in MWh
E_RS	Numeric	Reserve Shutdown Hours in MWh
E_NC	Numeric	Noncurtailing Hours in MWh
E_EUFDH_RS	Numeric	Equivalent Unplanned (Forced) Derated Hours During RS in MWh

Event Hours

Field	Type	Description
E_EPDH_RS	**Numeric**	**Equivalent Planned Derated Hours During RS in MWh**
E_EMDH_RS	**Numeric**	**Equivalent Maintenance Derated Hours During RS in MWh**
E_SH	**Numeric**	**Service Hours in MWh**
E_PH	**Numeric**	**Period Hours in MWh**
E_ESEDH	**Numeric**	**Equivalent Seasonal Derated Hours in MWh**
E_AH	**Numeric**	**Available Hours in MWh**
PumpingHours	**Numeric**	**Pumping Hours from Performance 02 record (monthly only)**
SynchHours	**Numeric**	**Synchronous Condensing Hours from Performance 02 record (monthly only)**
E_PumpingHours	**Numeric**	**Pumping Hours expressed in MWh from Performance 02 record (monthly only)**
E_SynchHours	**Numeric**	**Synchronous Condensing Hours expressed in MWh from Performance 02 record (monthly only)**
Granularity	**Character**	**The calculation period used in the calculation: monthly, weekly, yearly, etc.**
PlantMgtControl	**Numeric**	**Reserved for future use**
UnitAge	**Numeric**	**Age of the unit in years at the end of the period (at TL_DateTime)**
AH_OMC	**Numeric**	**Reserved for future use**
FOH_OMC	**Numeric**	**Reserved for future use**
EFDH_OMC	**Numeric**	**Reserved for future use**
E_AH_OMC	**Numeric**	**Reserved for future use**
E_FOH_OMC	**Numeric**	**Reserved for future use**
E_EFDH_OMC	**Numeric**	**Reserved for future use**

Event Details

Field	Type	Description
UnitShortName	Character	An abbreviated form of the unit's name
UtilityUnitCode	Character	Unit's NERC-assigned Utility Unit Code (6 characters)
EventNumber	Numeric	Event Number
EventType	Character	Event Type
TL_DateTime	DateTime	End-of-period date/time
ContribCode	Numeric	Event Contribution Code (modified for sort)
EventContribCode	Numeric	Event Contribution Code
EquipGroupName	Character	Cause Code Group Name
CauseCode	Numeric	System/Component Cause Code
CauseCodeExt	Character	System/Component Cause Code Extension
CalcHours	Numeric	Event Duration – Calculated Hours
EquivHours	Numeric	Event Duration – Equivalent Hours
EV_DateTime	DateTime	Start of Event Date/Time
EquivMWh	Numeric	Equivalent Megawatt Hours
EUFDH_RS	Numeric	Equivalent Unplanned (Forced) Derated Hours during Reserve Shutdown (for D1, D2, and D3 only)
E_EUFDH_RS	Numeric	Equivalent Unplanned (Forced) Derated Hours during Reserve Shutdown in MWh (for D1, D2, and D3 only)
EPDH_RS	Numeric	Equivalent Planned Derated Hours during Reserve Shutdown (for D1, D2, and D3 only)
E_EPDH_RS	Numeric	Equivalent Planned Derated Hours during Reserve Shutdown in MWh (for D1, D2, and D3 only)
EMDH_RS	Numeric	Equivalent Maintenance Derated Hours during Reserve Shutdown (for D1, D2, and D3 only)
E_EMDH_RS	Numeric	Equivalent Maintenance Derated Hours during Reserve Shutdown in MWh (for D1, D2, and D3 only)
ExtensionType	Character	If the EventType field is an SE or DE, then this is a PO, MO, PD, or D4
LFilter	Logical	Internal; not normally used outside program
Granularity	Character	The calculation period used in the calculation: monthly, weekly, yearly, etc.
PlantMgtControl	Numeric	Reserved for future use
PJMIOCode	Character	Reserved for future use

Event Records

Field	Type	Description
UnitShortName	Character	An abbreviated form of the unit's name
EventNumber	Numeric	Event Number
EventType	Character	Event Type
StartDateTime	DateTime	Start of Event Date
EndDateTime	DateTime	End of Event Date
EventContribCode	Numeric	Event Contribution Code
EquipGroupName	Character	Cause Code Group Name
CauseCode	Numeric	System/Component Cause Code
CauseCodeExt	Character	System/Component Cause Code Extension
VerbalDesc86	Character	Verbal Description
VerbalDescFull	Character	Expanded Verbal Description
ClockHours	Numeric	Event Duration – Clock Hours
CalcHours	Numeric	Event Duration – Calculated Hours
EquivHours	Numeric	Event Duration – Equivalent Hours
WorkStarted	DateTime	Time: Work Started Date/Time
WorkEnded	DateTime	Time: Work Completed Date/Time
GrossAvailCapacity	Numeric	Gross Available Capacity
NetAvailCapacity	Numeric	Net Available Capacity
ManhoursWorked	Numeric	Hours Worked on this System/Component
ContribCode	Numeric	Contribution Code
EquivMWh	Numeric	Equivalent MW Hours
lFilter	Logical	Internal; not normally used outside program
ExtensionType	Character	If the EventType field is an SE or DE, then this is a PO, MO, PD, or D4
CarryOverLastYear	Logical	Did this event carry over from previous year?
CarryOverNextYear	Logical	Does the event carry over into the next year?
FailureMechCode	Character	NERC Expanded Reporting Failure Mechanism Code
TripMech	Character	A – automatic/M – manual
CumFiredHours	Numeric	Cumulative fired hours at the time of the event
CumEngineStarts	Numeric	Cumulative number of starts at the time of the event
DominantDerate	Numeric	Reserved for future use
PlantMgtControl	Numeric	Reserved for future use
PJMIOCode	Character	Reserved for future use

Performance Records

Field	Type	Description
UnitShortName	**Character**	**An abbreviated form of the unit's name**
UtilityUnitCode	**Character**	**Unit's NERC-assigned Utility Unit Code (6 characters)**
Year	**Numeric**	**Year**
Period	**Character**	**Month or Quarter**
GrossMaxCap	**Numeric**	**Gross maximum capacity**
GrossDepCap	**Numeric**	**Gross dependable capacity**
GrossGen	**Numeric**	**Gross actual generation**
NetMaxCap	**Numeric**	**Net maximum capacity**
NetDepCap	**Numeric**	**Net dependable capacity**
NetGen	**Numeric**	**Net actual generation**
PriFuelCode	**Character**	**PRIMARY GADS fuel code**
PriQtyBurned	**Numeric**	**Quantity burned with decimal point**
PriAvgHeatContent	**Numeric**	**Average heat content (nuclear: net heat rate)**
PriBtu	**Numeric**	**Primary fuel Btu**
PriPercentAsh	**Numeric**	**% ash**
PriPercentMoisture	**Numeric**	**% moisture**
PriPercentSulfur	**Numeric**	**% sulfur**
PriPercentAlkalines	**Numeric**	**% alkalies**
PriGrindIndexVanad	**Numeric**	**Grindability index/% vanadium & phosphorous**
PriAshSoftTemp	**Numeric**	**Ash softening temperature**
SecFuelCode	**Character**	**SECONDARY GADS fuel code**
SecQtyBurned	**Numeric**	**Quantity burned with decimal point**
SecAvgHeatContent	**Numeric**	**Average heat content**
SecBtu	**Numeric**	**Secondary fuel Btu**
SecPercentAsh	**Numeric**	**% ash**
SecPercentMoisture	**Numeric**	**% moisture**
SecPercentSulfur	**Numeric**	**% sulfur**
SecPercentAlkalines	**Numeric**	**% alkalis**
SecGrindIndexVanad	**Numeric**	**Grindability index/% vanadium & phosphorous**
SecAshSoftTemp	**Numeric**	**Ash softening temperature**
TerFuelCode	**Character**	**TERTIARY GADS fuel code**
TerQtyBurned	**Numeric**	**Quantity burned with decimal point**
TerAvgHeatContent	**Numeric**	**Average heat content**
TerBtu	**Numeric**	**Tertiary fuel Btu**
TerPercentAsh	**Numeric**	**% ash**
TerPercentMoisture	**Numeric**	**% moisture**
TerPercentSulfur	**Numeric**	**% sulfur**
TerPercentAlkalines	**Numeric**	**% alkalis**
TerGrindIndexVanad	**Numeric**	**Grindability index/% vanadium & phosphorous**
TerAshSoftTemp	**Numeric**	**Ash softening temperature**

Performance Records

Field	Type	Description
QuaFuelCode	Character	QUATERNARY GADS fuel code
QuaQtyBurned	Numeric	Quantity burned with decimal point
QuaAvgHeatContent	Numeric	Average heat content
QuaBtu	Numeric	Quaternary fuel Btu
QuaPercentAsh	Numeric	% ash
QuaPercentMoisture	Numeric	% moisture
QuaPercentSulfur	Numeric	% sulfur
QuaPercentAlkalines	Numeric	% alkalis
QuaGrindIndexVanad	Numeric	Grindability index/% vanadium & phosphorous
QuaAshSoftTemp	Numeric	Ash softening temperature
ServiceHoursCalc	Numeric	Service hours
PeriodHours	Numeric	Period hours
NOF	Numeric	Net output factor
GOF	Numeric	Gross output factor
NCF	Numeric	Net capacity factor
GCF	Numeric	Gross capacity factor
NHR	Numeric	Net heat rate
GHR	Numeric	Gross heat rate
TotalBtu	Numeric	Total Btu = (PRI_BTU + SEC_BTU + TER_BTU + QUA_BTU)
AttemptedStarts	Numeric	Attempted starts
ActualStarts	Numeric	Actual starts
StartingReliability	Numeric	Starting reliability
PerfCalcDate	Date	End of month in DATE format
ServiceHours	Numeric	Service Hours (Performance 02 Card)
RSHours	Numeric	Reserve Shutdown Hours (Performance 02 Card)
PumpingHours	Numeric	Pumping Hours (Performance 02 Card)
SynchCondHours	Numeric	Synchronous Condensing Hours (Performance 02 Card)
PlannedOutageHours	Numeric	Planned Outage Hours (Performance 02 Card)
ForcedOutageHours	Numeric	Forced Outage Hours and Startup Failure Hours Performance 02 Card)
MaintOutageHours	Numeric	Maintenance Outage Hours (Performance 02 Card)
ExtofSchedOutages	Numeric	Extension of Scheduled Outages (Performance 02 Card)
lQuarterlyData	Logical	Internal; not normally used outside program
JOGrossMaxCap	Numeric	Joint Ownership Share of GMC
JOGrossGen	Numeric	Joint Ownership Share of Gross Generation
JONetMaxCap	Numeric	Joint Ownership Share of NMC
JONetGen	Numeric	Joint Ownership Share of Net Generation

Performance Records

Field	Type	Description
JOPriQtyBurned	**Numeric**	**Joint Ownership Share of Primary Fuel Quantity Burned**
JOSecQtyBurned	**Numeric**	**Joint Ownership Share of Secondary Fuel Quantity Burned**
JOTerQtyBurned	**Numeric**	**Joint Ownership Share of Tertiary Fuel Quantity Burned**
JOQuaQtyBurned	**Numeric**	**Joint Ownership Share of Quaternary Fuel Quantity Burned**
JOTotalBtu	**Numeric**	**Joint Ownership Share of Total Fuel Btu**
TimeStamp	**DateTime**	**Internal; not normally used outside program**
UnitAge	**Numeric**	**Age of the unit at the end of the month**
G_ServiceHours	**Numeric**	**Reserved for future use**
G_PeriodHours	**Numeric**	**Reserved for future use**
G_ServiceHoursCalc	**Numeric**	**Reserved for future use**
N_ServiceHours	**Numeric**	**Reserved for future use**
N_PeriodHours	**Numeric**	**Reserved for future use**
N_ServiceHoursCalc	**Numeric**	**Reserved for future use**

EFORd

Field	Type	Description
UnitShortName	Character	An abbreviated form of the unit's name
Granularity	Character	Monthly
TL_DateTime	DateTime	End-of-period date/time
PO	Numeric	Planned Outage Hours (PO)
PO_SE	Numeric	Scheduled Outage Extension Hours of Planned Outages (SE)
MO	Numeric	Maintenance Outage Hours (MO)
MO_SE	Numeric	Scheduled Outage Extension Hours of Maintenance Outages (SE)
SF	Numeric	Startup Failure Hours (SF)
U1	Numeric	Unplanned (Forced) Outage Hours (U1)
U2	Numeric	Unplanned (Forced) Outage Hours (U2)
U3	Numeric	Unplanned (Forced) Outage Hours (U3)
D1	Numeric	Equivalent Unplanned (Forced) Derated Hours (D1)
D2	Numeric	Equivalent Unplanned (Forced) Derated Hours (D2)
D3	Numeric	Equivalent Unplanned (Forced) Derated Hours (D3)
D4	Numeric	Equivalent Maintenance Derated Hours (D4)
D4_DE	Numeric	Extension of Maintenance Derating Equivalent Hours (DE)
PD	Numeric	Equivalent Planned Derated Hours (PD)
PD_DE	Numeric	Extension of Planned Derating Equivalent Hours (DE)
RS	Numeric	Reserve Shutdown Hours
EUFDH_RS	Numeric	Equivalent Unplanned (Forced) Derated Hours During RS
SH	Numeric	Service Hours
PH	Numeric	Period Hours
ESEDH	Numeric	Equivalent Seasonal Derated Hours
AH	Numeric	Available Hours
E_PO	Numeric	Planned Outage Hours (PO) in MWh
E_PO_SE	Numeric	Scheduled Outage Extension Hours of Planned Outages (SE) in MWh
E_MO	Numeric	Maintenance Outage Hours (MO) in MWh
E_MO_SE	Numeric	Scheduled Outage Extension Hours of Maintenance Outages (SE) in MWh
E_SF	Numeric	Startup Failure Hours (SF) in MWh
E_U1	Numeric	Unplanned (Forced) Outage Hours (U1) in MWh
E_U2	Numeric	Unplanned (Forced) Outage Hours (U2) in MWh
E_U3	Numeric	Unplanned (Forced) Outage Hours (U3) in MWh
E_D1	Numeric	Equivalent Unplanned (Forced) Derated Hours (D1) in MWh
E_D2	Numeric	Equivalent Unplanned (Forced) Derated Hours (D2) in MWh

EFORd

Field	Type	Description
E_D3	**Numeric**	**Equivalent Unplanned (Forced) Derated Hours (D3) in MWh**
E_D4	**Numeric**	**Equivalent Maintenance Derated Hours (D4) in MWh**
E_D4_DE	**Numeric**	**Extension of Maintenance Derating Equivalent Hours (DE) in MWh**
E_PD	**Numeric**	**Equivalent Planned Derated Hours (PD) in MWh**
E_PD_DE	**Numeric**	**Extension of Planned Derating Equivalent Hours (DE) in MWh**
E_RS	**Numeric**	**Reserve Shutdown Hours in MWh**
E_EUFDH_RS	**Numeric**	**Equivalent Unplanned (Forced) Derated Hours During RS in MWh**
E_SH	**Numeric**	**Service Hours in MWh**
E_PH	**Numeric**	**Period Hours in MWh**
E_ESEDH	**Numeric**	**Equivalent Seasonal Derated Hours in MWh**
E_AH	**Numeric**	**Available Hours in MWh**
FOCount	**Numeric**	**Number of forced outage events**
RSCount	**Numeric**	**Number of Reserve Shutdown events**
ActualStartsCount	**Numeric**	**Count of number of actual starts**
AttemptedStartsCount	**Numeric**	**Count of number of attempted starts**
AttemptedStarts	**Numeric**	**Number of Attempted Starts**
ActualStarts	**Numeric**	**Number of Actual Starts**
StartingReliability	**Numeric**	**Starting Reliability (%)**
GrossMaxCap	**Numeric**	**Gross Maximum Capacity for period**
NetMaxCap	**Numeric**	**Net Maximum Capacity for period**
PumpingHours	**Numeric**	**Pumping Hours from Performance 02 record (monthly only)**
SynchCondHours	**Numeric**	**Synchronous Condensing Hours from Performance 02 record (monthly only)**
E_PumpingHours	**Numeric**	**Pumping Hours expressed in MWh from Performance 02 record (monthly only)**
E_SynchCondHours	**Numeric**	**Synchronous Condensing Hours expressed in MWh from Performance 02 record (monthly only)**
GMC_Weight	**Numeric**	**A GMC value for fleet calculations**
NMC_Weight	**Numeric**	**An NMC value for fleet calculations**
ServiceHourMethod	**Numeric**	**Used by the program to determine which formula to use for determining service hours**
DEFOR	**Numeric**	**Demand EFOR (EFORd)**
DFOR	**Numeric**	**Demand FOR (FORd)**
FP	**Numeric**	**Partial F-factor**
FF_ID	**Numeric**	**Full F-Factor 1/D term**
FF_IT	**Numeric**	**Full F-Factor 1/T term**
FF_IR	**Numeric**	**Full F-Factor 1/r term**
FF	**Numeric**	**Full F-Factor**
FF_D	**Numeric**	**Full F-Factor D term**
FF_T	**Numeric**	**Full F-Factor T term**
FF_R	**Numeric**	**Full F-Factor r term**

EFORd

Field	Type	Description
FL_Numerator	Numeric	EFORd formula numerator
FL_Denominator	Numeric	EFORd formula denominator
FL_FORdNumerator	Numeric	FORd formula numerator
FOCount_OMC	Numeric	Reserved for future use
FOH_OMC	Numeric	Reserved for future use
AH_OMC	Numeric	Reserved for future use
EFDH_OMC	Numeric	Reserved for future use
E_FOH_OMC	Numeric	Reserved for future use
E_AH_OMC	Numeric	Reserved for future use
E_EFDH_OMC	Numeric	Reserved for future use

EFORd Total

Field	Type	Description
UnitShortName	Character	An abbreviated form of the unit's name
UnitName	Character	Unit or Group name
UtilityUnitCode	Character	Unit's NERC-assigned Utility Unit Code (6 characters) – Group's program-generated Utility Unit Code
PeriodStart	DateTime	Beginning of period date/time
PeriodEnd	DateTime	End of period date/time
SF	Numeric	Startup Failure Hours (SF)
U1	Numeric	Unplanned (Forced) Outage Hours (U1)
U2	Numeric	Unplanned (Forced) Outage Hours (U2)
U3	Numeric	Unplanned (Forced) Outage Hours (U3)
D1	Numeric	Equivalent Unplanned (Forced) Derated Hours (D1)
D2	Numeric	Equivalent Unplanned (Forced) Derated Hours (D2)
D3	Numeric	Equivalent Unplanned (Forced) Derated Hours (D3)
RS	Numeric	Reserve Shutdown Hours
EUFDH_RS	Numeric	Equivalent Unplanned (Forced) Derated Hours During RS
SH	Numeric	Service Hours
AH	Numeric	Available Hours
FOCount	Numeric	Number of forced outage events
RSCount	Numeric	Number of Reserve Shutdown events
ActualStartsCount	Numeric	Count of number of actual starts
AttemptedStartsCount	Numeric	Count of number of attempted starts
AttemptedStarts	Numeric	Number of Attempted Starts
ActualStarts	Numeric	Number of Actual Starts
ServiceHourMethod	Numeric	Used by the program to determine which formula to use for determining service hours
DEFOR	Numeric	Demand EFOR (EFORd)
DFOR	Numeric	Demand FOR (FORd)
FL_Numerator	Numeric	EFORd formula numerator
FL_Denominator	Numeric	EFORd formula denominator
FL_FORdNumerator	Numeric	FORd formula numerator

Importing GADS Open Source Database Data into Microsoft Excel

Following are the simple steps required to create custom Excel spreadsheets and Excel-based reports.

1. From the **Main** menu, select **Data | Import External Data | New Database Query**.

   After you have completed all of the following steps to create a New Database Query, you will at this point choose the submenu item "Run Saved Query" instead of "New Database Query" to re-run any previously created and saved queries to produce the desired spreadsheets or reports.

   The next screen shows these two levels of drop-down menus.

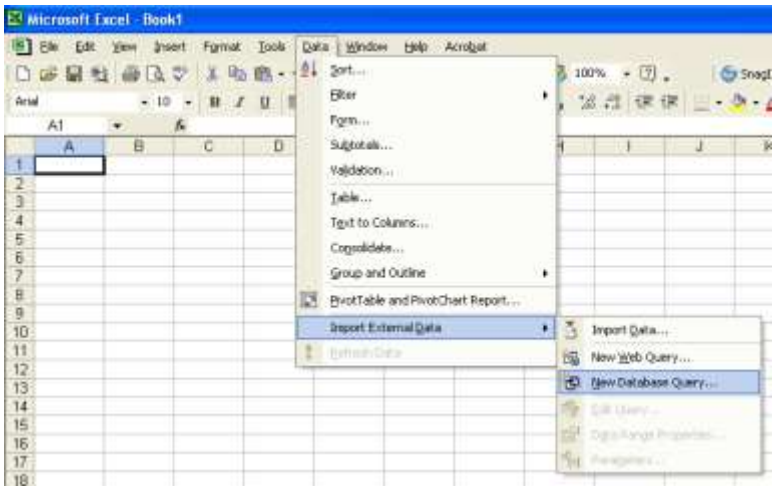

Figure 68. New Database Query Process

2. After choosing **New Database Query**, the dialog boxes on the next page allow ou to connect to the GADS Open Source database GADSNG and to select the tables and fields to be included in the resultant Excel spreadsheet.

   Select **<New Data Source>**.

   Enter the name you want to give to your data source. In the example in Figure 68, it is called "GADS Open Source Output," but you may give it any name you want. Since you might be creating several or many different reports, you can give them meaningful names.

   Pick the driver for the type of database you want to access:

- SQL Server for SQL Server 7/2000
  - Microsoft Access Driver (*.mdb) for Microsoft Access
- Microsoft ODBC for Oracle for Oracle 8i/9i

   Click **Connect** and provide the SQL Server Login information including the Options Database of GADSNG.

   These steps are illustrated in Figure 69.

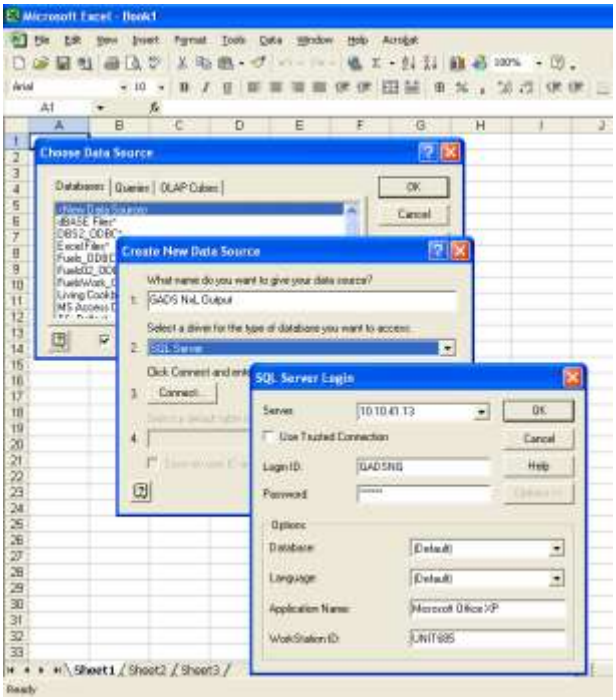

Figure 69. Create New Database Query

3. Once you have completed the steps shown in Figure 69, you can select the GADS Open Source table to import into the Excel spreadsheet.

   As shown in Figure 70, the PerformanceRecords table has been selected to import with this Query.

   The PerformanceRecords table is an output/results table from GADS Open Source Analysis & Reporting.

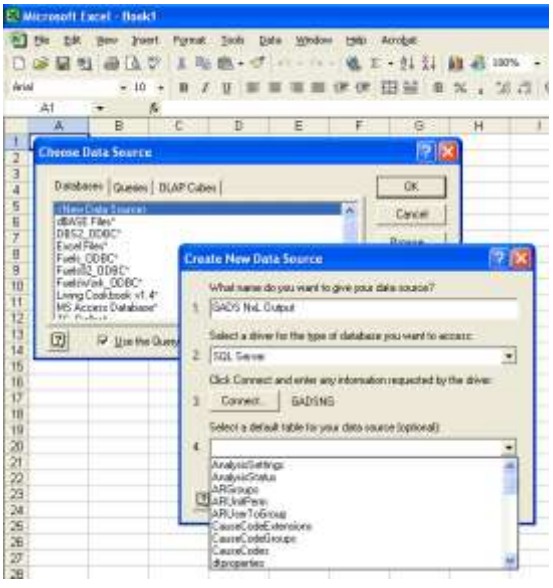

Figure 70. Select Default Table for Data Source

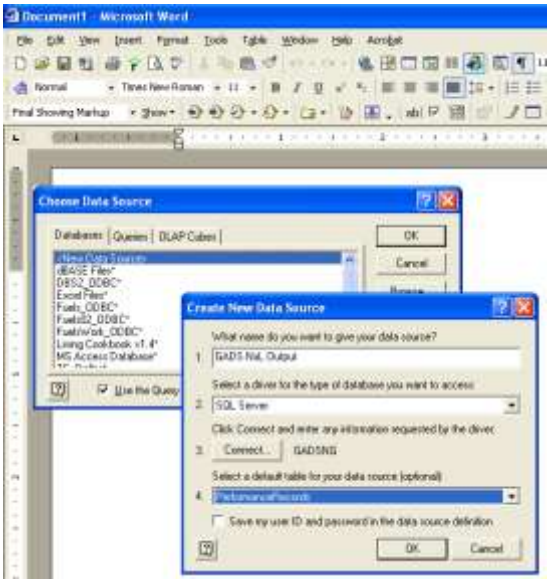

Figure 71. Select Default Table for Data Source Example

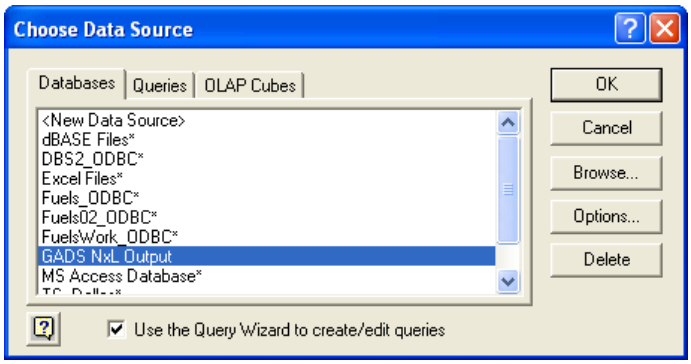

Figure 72. Select Data Source

4. The steps above create a New Data Source that becomes an available source of data for importing into Excel.

   This completes the query setup, and you can now open the "GADS Open Source Output" directly with having to repeat the steps each time.

   Continue with the Query Wizard to choose the columns from the PerformanceRecords table that you want to include in the Excel spreadsheet.

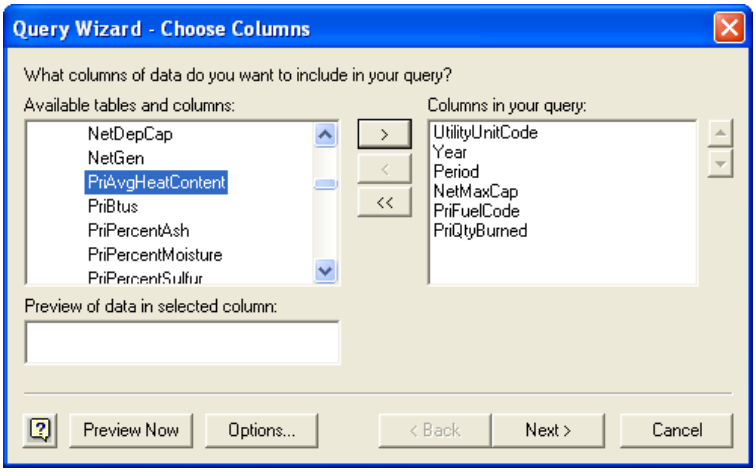

Figure 73. Choose Report Columns

In Figure 73, the NERC Utility Unit Code, the period and year of the data (e.g., 02/2002), the net maximum capacity, the primary fuel code (such as "CC" for coal), and the primary quantity fuel burned (in the case of coal this would be thousands of tons) columns have been chosen.

Use the Wizard to select data from another table and/or additional columns as necessary. Preview the data to be sure you are getting the data you expect.

Clicking **Next >** takes you to the following screen.

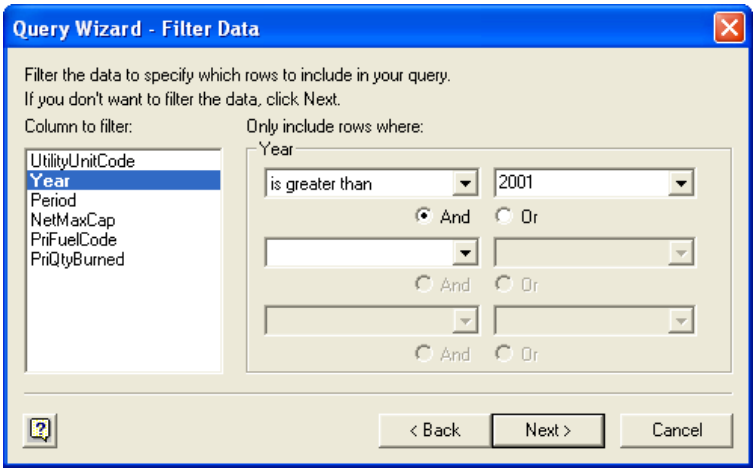

Figure 74. Select Query Filter

The Query Wizard – Filter Data creates "filters" or "selection criteria" to narrow or limit the amount of data returned to or imported into the Excel spreadsheet. In the example in Figure 74, the years have been restricted to years greater than 2001 (i.e., 2002, 2003,). You can add up to two additional select or filter criterion.

Clicking **Next >** takes you to the dialog on the following screen.

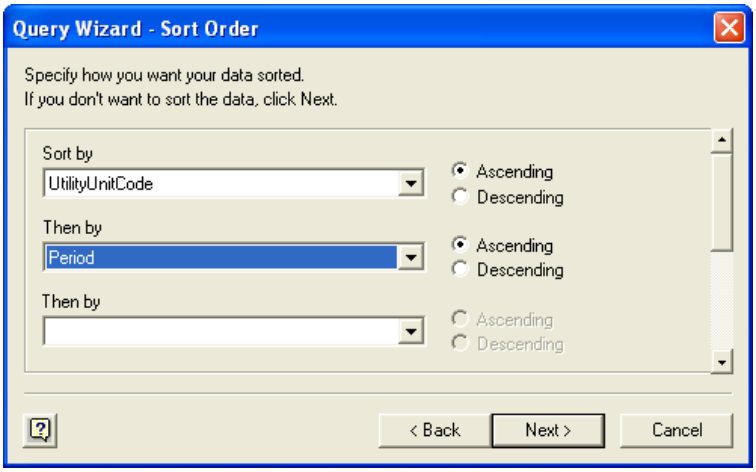

Figure 75. Create Sort Order

While you can also sort the Excel spreadsheet columns, this screen allows the data to be sorted when it is loaded. The options chosen in Figure 75 tells the program sort the data first by the Utility Unit Code field and then by the Period.

Clicking **Next >** takes you to the dialog shown in Figure 76.

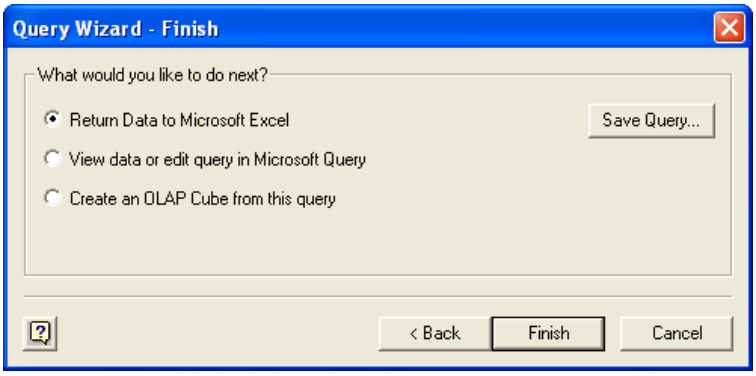

Figure 76. Finish Query Wizard

Click **Save Query…** before finishing the Wizard and populating the Excel spreadsheet with the desired data from the GADS Open Source database. If this is a one-time request, you can proceed immediately to populating the spreadsheet by clicking **Finish**.

Save Query… brings up the dialog window shown in Figure 77 where you can give the report a meaningful name such as "Monthly report to regional managers."

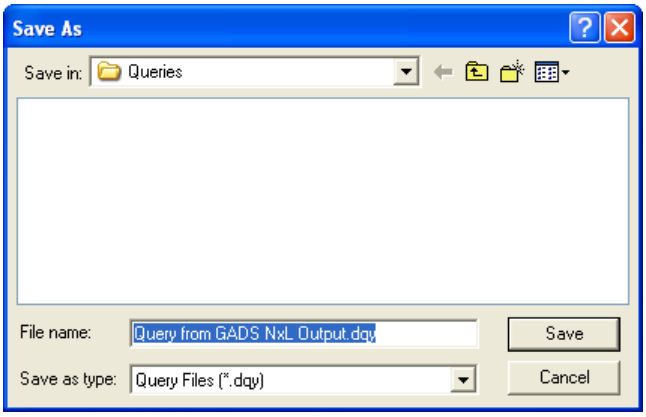

Figure 77. Save Query

When you click **Finish**, either immediately or after having saved the query, the dialog box in Figure 78 appears, asking where in the Excel spreadsheet you want to load the data. The default is cell A1 on the current sheet.

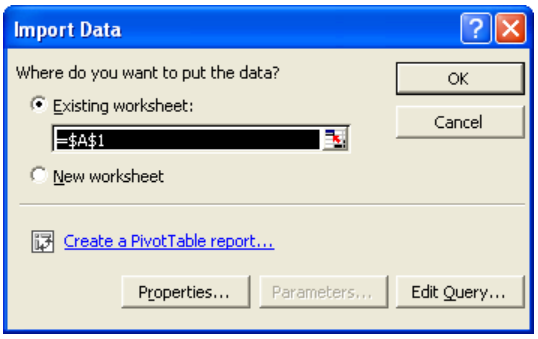

Figure 78. Import Data to Existing Worksheet

At this point the data is loaded, and you can customize it and any Excel-based reports as needed.

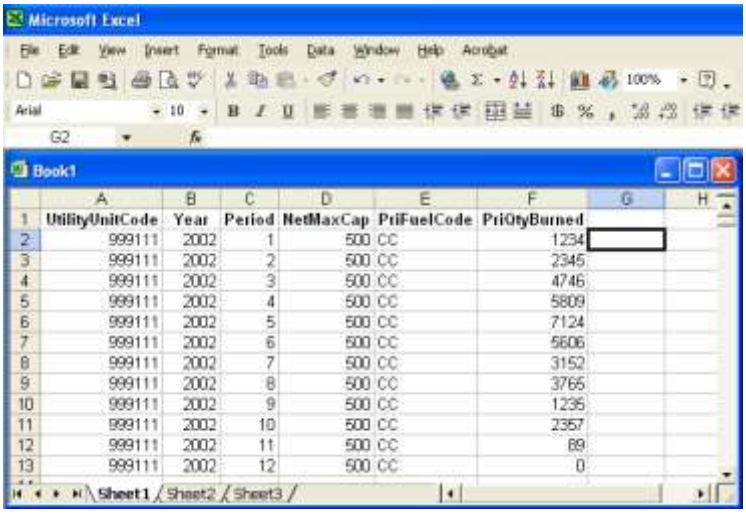

Figure 79. Example Data Saved in Excel Spreadsheet

Exiting the Program

Be sure to submit your current work before exiting the program or shutting down your machine; otherwise, you will lose all work done since the last submission.

To exit, select **File** from the **Main** menu, and then choose **Exit**.

With the Windows UI, you should always exit the program from the **Main** menu and always exit the program completely before shutting down your computer. Do not turn the computer off during the operation of this software without properly exiting the program; doing so may cause unrecoverable data loss.

Due to the nature of web-based applications, it is not required that you exit the Web UI before shutting down your computer.

Tips & Tricks

Steam Cycle Heat Rate

How is the steam cycle heat rate of a combined cycle unit calculated?

A combined cycle plant incorporates a highly fuel-efficient process that involves generating electricity in combustion turbines and utilizing the procedure‘s hot exhaust (waste heat) to create water vapor, which is then used to generate additional electricity in a steam turbine. Heat rate is a measure of energy efficiency that defines how much fuel it takes to generate a kilowatt-hour of electricity.

The combined cycle plant involves the sequential use of the fuel energy in both the gas turbine generator and the steam turbine generator. The steam turbine operates in conjunction with the gas turbine(s), providing extra generation to the station at an effective heat rate of zero, ignoring any duct burners.

Therefore, heat rates are defined for the gas turbines and for the combined cycle, but not the steam cycle by itself.

Using the GADS fuel and generation data and the performance reports from GADS Open Source, you can determine the approximate overall heat rate of the combined cycle plant and an approximate heat rate for each gas turbine. Based on these heat rates, it you can infer the approximate heat rates for the steam turbine; however, the computation is somewhat involved.

Normally, the overall heat rate (Btu/kWh) for the combined cycle is calculated by summing the fuel burned in each of the gas turbines and the fuel burned in the duct burners (expressed in Btu) and dividing the summed Btu value by the total generation (kWh) from the gas turbine generator(s) and the steam turbine generator.

So the answer to the question is that the heat rate for the steam cycle is not normally calculated by itself. It can be accurately calculated by testing and by performing a detailed heat balance for the steam cycle.

Example 3D Calculation

What is the Example 3D calculation option?

This setting in the GADS Open Source Analysis & Reporting software applies specifically to calculating overlapping deratings. This setting causes all overlapping deratings to be calculated, as shown in Example 3D in the *NERC GADS DRI*, Appendix G.

The calculations deal with overlapping deratings when the first derating ends before the second derating, but the capacity of the unit does not change. The assumption is that the derating C in Example 3D is not created by the GADS reporter. It is also assumed that the capacity of the unit stayed at the same net available capacity as the derating B until the traveling screen (cause code 3260) repair is completed.

In looking at Example 3D, the unit net available capacity is assumed to continue to be 360 MW from March 10 at 07:45 (the start of the B derating) through March 10 at 19:00 (the end of the C derating).

Therefore, with the option set, the software calculates the C portion as if the unit capacity stayed at the same available capacity as the derating B (i.e., a 240 MW derating for 8.50 hours which results in 3.40 equivalent hours). As a result, the total B equivalent hours is now 4.04 equivalent hours.

Before selecting this option, please be sure that this is the way your company assumes overlapping deratings are calculated under these circumstances.

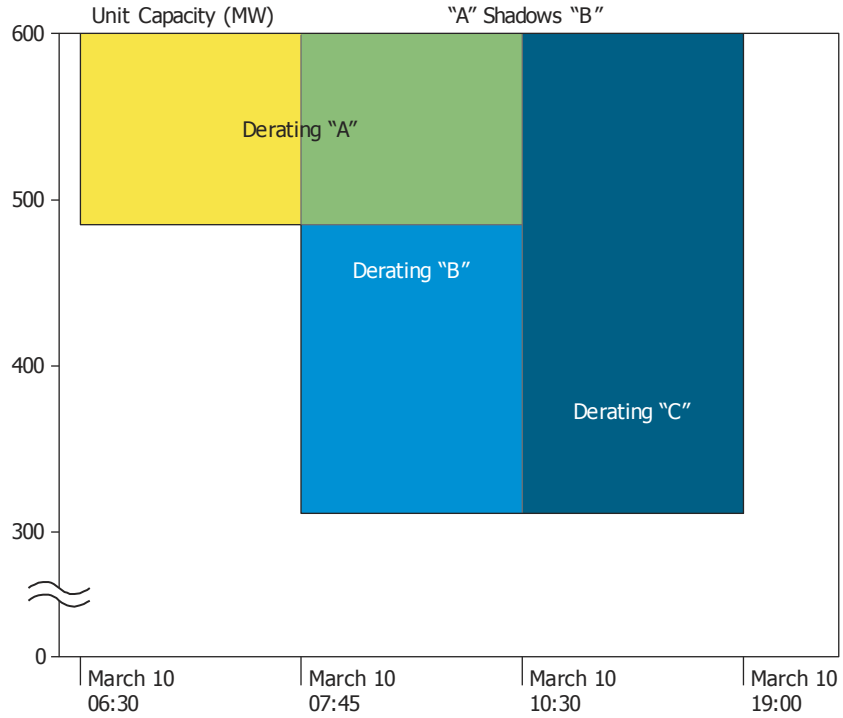

Figure 80. Example 3D Deratings

Troubleshooting

If any specific problems arise, you should first contact the person responsible for coordinating the GADS Open Source applications at your company. If you are unable to resolve your problem, you may contact us by phone at 972-625-5653 or by e-mail at Coordinator@GADSOpenSource.com.

In the unlikely event that you encounter an error while using the software, we have tried to find a "graceful" way to recover from errors and present you with a description of the problem that occurred (i.e., to "trap" the error). However, it is possible that some errors may not get trapped and the software simply stops, without any obvious indication of what caused the problem. If this does happen, we will need to work with you to determine what may have been the cause.

If an error does occur, you may be asked to open the Event Viewer on the machine or application server where the error occurred for the Windows UI or the web server for the Web UI. Generally, the Event Viewer is available in the Administrative Tools for your Windows operating system.

We also recommend that you press ALT+PRINT SCREEN (press the ALT key, hold it down, and press the PRINT SCREEN key) to capture the "active window" to the Windows clipboard. You can then open WordPad or Microsoft® Word (Notepad will not work for this purpose) to paste the screen shot into the new document. Make sure the window with the error message is displayed in the document. If not, simply minimize the editor, click on the top of the window that displays the error, and repeat the process of capturing the active window to the clipboard and pasting it into the editor. Save the document in case it is needed to resolve the problem.

All errors should be captured under the Application Log section of the event viewer, as shown in Figure 81.

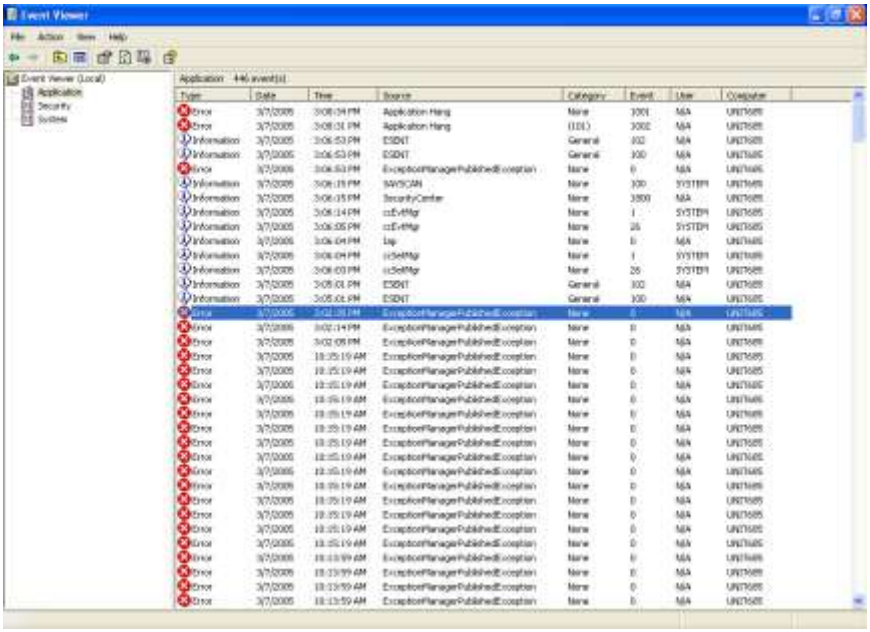

Figure 81. Event Viewer for Application Errors

Click on the error to get the dialog box shown in Figure 82 detailing the problem.

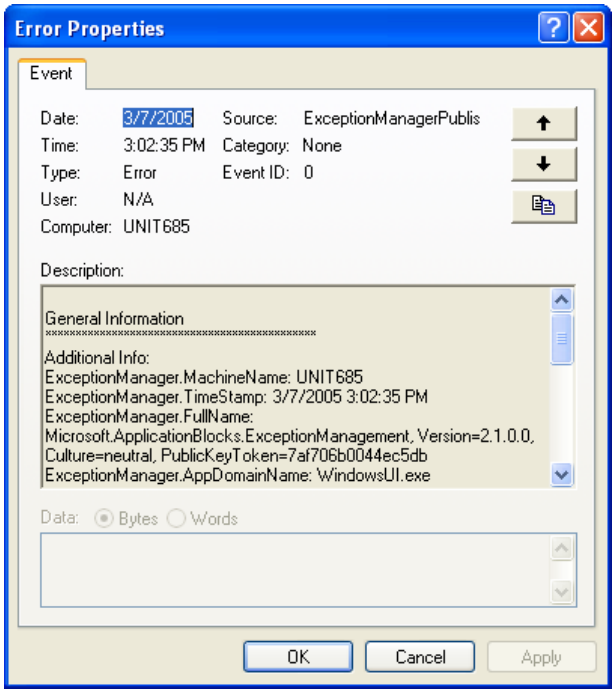

Figure 82. Error Details Example

You can view the details by looking at the Description section using the scroll bar on the right side of the Description area.

The bottom button at the top right side copies the details to the Windows clipboard. You can then "paste" the information into any text editor, such as Notepad, WordPad, or Microsoft Word.

You can save the file in case it is necessary to e-mail the details of the error, including the screen shot captured earlier, to your company's coordinator or to us.

Timeout Expired

If you receive an unhandled exception of type "GADSNG.DAL.DataFactoryException" occurring in GADSNGDataFactory.dll and the indicated error is:

Class: 10

Error # -2: Timeout expired. The timeout period elapsed prior to completion of the operation or the server is not responding. on line 0.

Error reported by .Net SqlClient Data Provider while connected to…

ensure that the settings shown in Figure 83 are applied.

If the MCMS server is running on the same system as the SQL server (i.e., the MCMS server is a local client of Microsoft SQL Server), adjust the SQL Client Network settings as follows (this is accessible through the Microsoft SQL Server\Client Network Utility | Start Menu item:

- Uncheck Enable shared memory protocol
- Rearrange the Enabled protocols by order: so that Named Pipes comes before TCP/IP
- If necessary, restart Microsoft Internet Information Server (IIS)

This error can occur regardless of the database size.

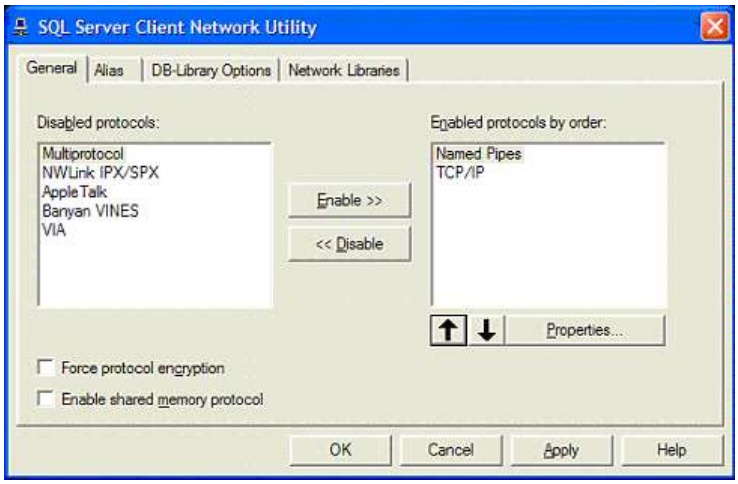

Figure 83. SQL Server Client Network Utility – Enable Protocols

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Installation & Quick Start

Installation

*Verify that all the required supporting software has been installed by first clicking **Check Now**. In addition to determining whether the prerequisite software is installed, you can install the needed software directly from the installation CD.*

*The ODBC .NET Data Provider Windows Installer Package odbc_net.msi can be found on the installation CD in the **ODBC Data Provider** folder.*

This section takes you briefly through installing the GADS Open Source Data Entry application and highlights any special installation considerations.

It is recommended that you close all other programs running under Windows.

The Windows User Interface installation requires that all machines running the Data Entry application have Microsoft .NET Framework version 1.1 and the ODBC .NET Data Provider installed on the machine—even if the GADS application itself is installed on a network drive. This is a requirement for all Microsoft .NET Windows applications. **The Web UI does not require this software to be installed on the user's machines, but it must be installed on the same web server as the GADS application.**

The installation requires BOTH

- a GADS Open Source Data Entry installation CD
- a client-specific Keys.xml file, which is either supplied on a 3.5" diskette or sent via e-mail; it is not included on the installation CD.

Insert the GADS Open Source Data Entry installation CD into your CD drive. The GADS Open Source Data Entry Installer should start automatically.

If the installation does not start automatically:

- Click **Start** on the taskbar (**Start** is typically in the lower left corner of the screen) and then click **Run**.
- In the text box next to Open, type *E:\autorun.hta* (where E is the CD drive letter).
- Click **OK**.

(You can also open Windows Explorer and right-click on the CD-ROM drive. If the pop-up menu lists **AutoPlay** as an option, clicking **AutoPlay** will run the installation program. If **AutoPlay** is not listed, you can double-click on the file autorun.hta to manually start the installation process.)

You will then see the GADS Open Source Data Entry Installer as shown in Figure 84.

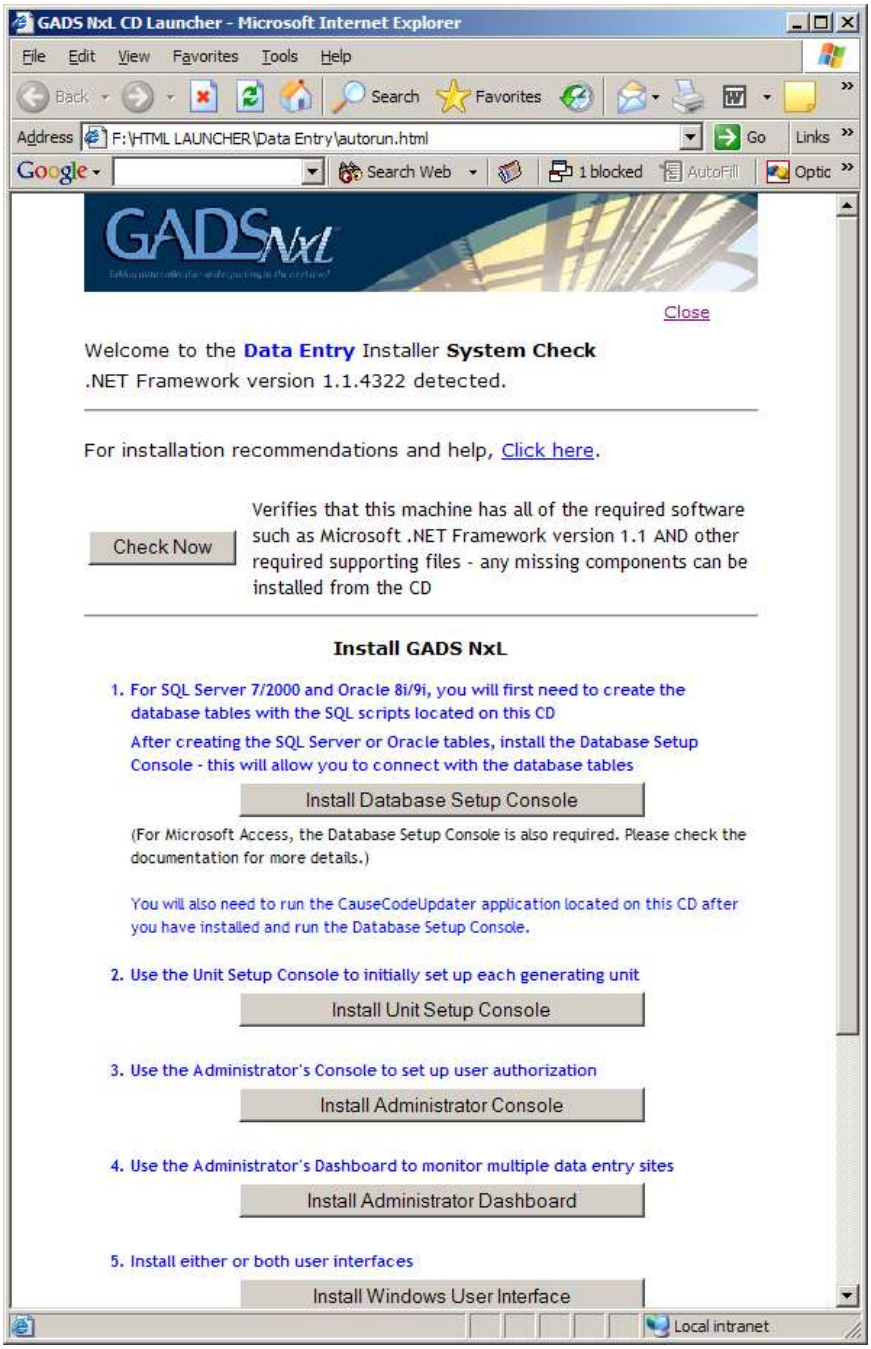

Figure 84. GADS Open Source Data Entry Installation Menu

The top of the Installer screen indicates whether or not the machine already has the Microsoft .NET Framework version 1.1 installed on it. If not, it can be installed by clicking **Check Now**.

First, verify that all the required software—at least at the minimum required version level—has been installed by clicking **Check Now**. Any required software needed can be installed directly from the GADS Open Source Data Entry installation CD.

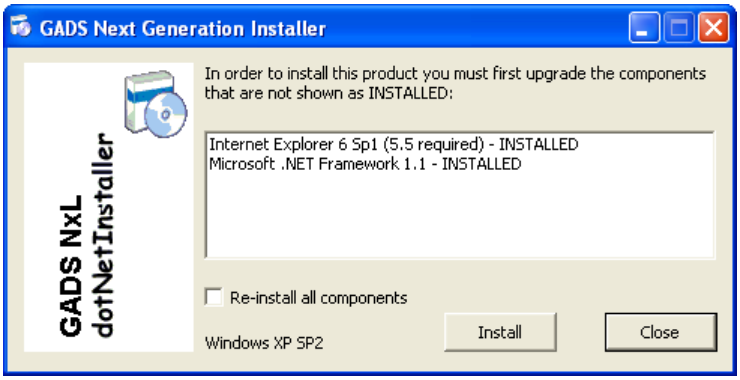

Figure 85. GADS Open Source dotNetInstaller

For the installation illustrated in Figure 85, Microsoft .NET Framework 1.1 and Microsoft Data Access Components 2.7 (or above) are not installed; however, Internet Explorer 5.5 (or above) is already installed (i.e., it shows – INSTALLED next to it in the list).

To install any missing required software, click **Install**. For example, if the Microsoft .NET Framework 1.1 and Microsoft Data Access Components (MDAC) 2.8 were not installed, they could be installed from this screen.

Since some of the software installations require restarting Windows, we recommend that you close all other Windows programs prior to installing the GADS Open Source Data Entry software.

The Installer determines whether your machine meets the minimum requirements for running the application. For example, the Installer requires that Internet Explorer 5.5 or above be installed—and the machine shown above meets that requirement because Internet Explorer 5.5 is already installed.

If your machine meets all of the minimum requirements, but you would like to install the latest updates (such as Internet Explorer 6 Service Pack 1), check the **Re-install all components** check box before clicking **Install**.

To install the missing component (for example, the Microsoft .Net Framework 1.1), click **Next**. Repeat the process for each component you wish to install.

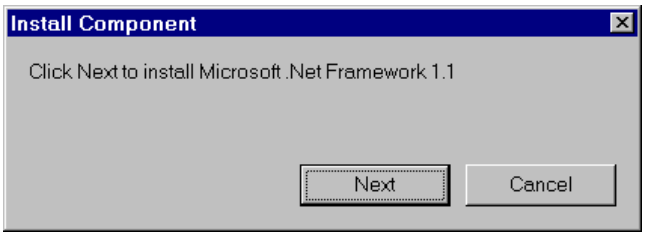

Figure 86. Install Component Dialog

The installer gives you the opportunity to cancel the installation for each missing piece of required software, in case you clicked **Install** by mistake, or you do not wish to install one or more of the missing required software components. Simply click **Cancel** prior to installation.

The installation steps are identified on the Installer screen—steps 1–4. Each step is discussed separately.

Remember to copy the Keys.xml file to the same folders as the installed applications.

After the installation steps are completed, copy the Keys.xml file to the same folder(s) where the Windows UI or Web UI applications were installed. For the Web UI, Keys.xml is installed in the "Secure" subfolder.

Be sure to have one or more secure backups of the Keys.xml file, since it is necessary to continue to run the application.

Additional software such as the SQL Server 2000 Desktop Engine (MSDE 2000) and the Adobe Reader can also be installed from the GADS Open Source Data Entry installation CD.

Install Database Setup/Server Console

For SQL Server 7/2000 and Oracle 8i/9i, you will first need to create the database and tables using the SQL scripts located on the Installation CD before running the **Unit Setup Console**.

After creating the SQL Server or Oracle tables, install the **Database Setup/Server Console**. This allows you to connect with the databases.

For Microsoft Access installations, the **Database Setup/Server Console** is also required to locate the GADSNG.mdb file in the default location, which is the same folder where the application was installed. The **Setup/Server Console** correctly configures the GADSNG.XML file to the full folder path name.

Install Unit Setup Console

The **Unit Setup Console** is used to input pedigree or setup information on the individual generating units for which you will be collecting GADS data. The **Unit Setup Console** is not optional and is required regardless of the database type.

Remember to copy the Keys.xml file to the same folders as the installed applications.

The total number of generating units you can enter using the **Unit Setup Console** is limited to the number your company specified when the software license was purchased. This value is stored in the Keys.xml file. This file is required, and must be installed in the same folder where the application was installed. If you install both the Windows User Interface and the Web User Interface, then the Keys.xml file must be copied into both installation folders with the applications. For the Web User Interface, both the Keys.xml and the GADSNG.xml files must be copied to the "Secure" folder of the virtual directory.

Install Administrator Console

The **Administrator (Admin) Console** allows you to set up authorizations for individual GADS data reporters, engineers, managers, or anyone who needs to generate reports, and to limit access to specific units and software functionality. The **Admin Console** uses the concept of defining authorization "report groups" and assigning generating units to each user-defined report group.

The Administrator also assigns individuals to the report groups, thereby controlling access to the functionality and reports for each group of units.

Typically, plant sites, divisions/regions, or plant types are defined as groups. The difference between Data Entry groups and Analysis & Reporting groups is that Data Entry groups are geared mostly to plant locations where the GADS data is being entered.

Analysis & Reporting groups, on the other hand, can include not only plant locations, but also fuel types, unit types, regions, equipment manufacturers (such as boiler manufacturers), operating modes, etc.—or any group for which you need to calculate key performance indicators. Individual units can be assigned to any number of groups.

For example, if your company has engineers responsible for tracking the performance of combustion turbines by OEM, use the **Admin Console** to create a group for each OEM. The same CTs may also be included in a plant site or fuel type group.

Enter information on each engineer and assign the engineer to the necessary group(s). An individual can also be assigned to one or more groups—as many as necessary; there is no need to create fictitious groups.

The **Admin Console** also allows you to restrict the activities the engineers are allowed to perform. You may want to allow only administrators to snapshot the GADS data over from the Data Entry tables and to perform calculations. But you may want to allow the engineers to generate reports for their assigned units and to perform custom calculations.

Analysis & Reporting performs standard calculations for all the selected granularities for all historical periods. The granularities are established for each group using the **Admin Console**. Each unit in a group is automatically assigned the established granularities.

For example, Dallas Unit 1, a gas-fired fossil steam unit, is assigned to both the fossil steam group and the gas-fired group. The fossil steam group needs reports for both monthly and yearly granularities. The gas-fired group needs daily and monthly granularities. Since Dallas Unit 1 is assigned to both groups, daily, monthly, and yearly calculations will be run on its data. All three granularities' factors and rates for Dallas Unit 1 will be stored in the database tables for quick and easy reporting.

Install Windows User Interface

The Windows UI is a rich user interface that has a look and feel similar to standard Windows applications such as Microsoft Word or Excel.

The Windows UI can be installed alone or in addition to the Web UI. However, if both are installed, they are typically installed to separate folders and quite possibly on separate servers. They can, however, "point" to the same database tables, so all GADS data is stored in the same tables.

The Windows UI is typically installed and run in one of the following ways:

- On each GADS data reporter's individual desktop or on the application server, with a shortcut automatically installed on the machine's desktop during the installation
- On a shared network drive, by mapping to the shared network drive/folder as shown in Figure 87 and using a manually created desktop shortcut with the **Target** and **Start in** fields referencing the correct folder on the network drive (e.g., T:\GADS Next Generation Data Entry\WindowsUI.exe)

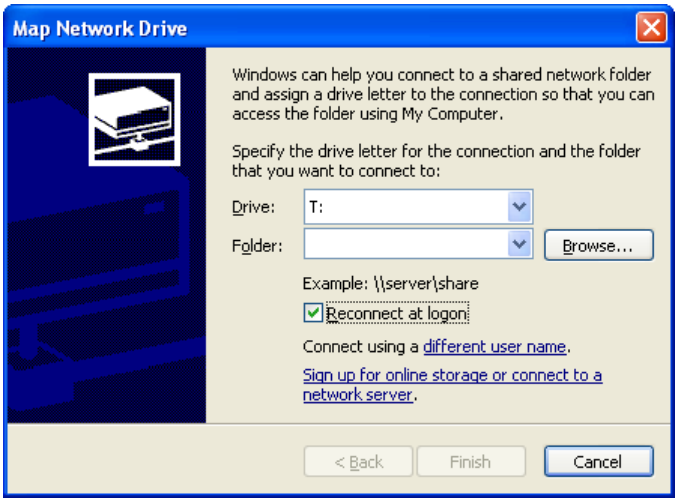

Figure 87. Windows Map Network Drive Dialog

- On a network drive, accessed via a manually created desktop shortcut to \\myServer\mySharedDrive\GADS Next Generation Data Entry\WindowsUI.exe

Any .NET application run on your local machine is fully trusted by default. If you run the same application from another machine, .NET checks to see what permissions that application has to run on your machine. Depending on your company's enterprise-wide settings, a .NET application may require permissions that have not been granted; so we supply our policy installer on the installation CD.

Since the application is on a non-local drive, the machine's .NET security policy may have to be modified to allow the Data Entry application to run on the subject machine.

The installation CD contains a setup file (policy installer) that modifies the local machine's security policy to allow the application to run. You can install it using either the Setup.exe or the .msi file.

Your company's required enterprise-wide runtime security policy is not modified. The security policy is changed only at the machine level, and grants Full Trust to the GADS Open Source applications.

The Data Entry application can then be run by clicking the desktop icon/shortcut using the proper path to the installation location.

Install Web User Interface

The Web UI is a browser-based user interface that has a look and feel similar to standard internet/intranet applications using a browser such as Microsoft Internet Explorer.

It does not require that any software be installed on the user's machine; however, we recommend that Internet Explorer version 5.5 or above be installed on the user's machine to take advantage of the capabilities offered by ASP.NET.

To ASP.NET, all browsers have either an UpLevel or DownLevel classification. UpLevel browsers are defined as Internet Explorer 5.5 and greater. DownLevel browsers are defined as Internet Explorer 5.01 and earlier, or browsers other than Internet Explorer. Microsoft ASP.NET web controls use this browser classification to determine which type of code to generate at runtime: client-side or server-side.

If a user has an UpLevel browser, the Web Controls generate client-side JavaScript and trap the action events directly on the client. If a user has a DownLevel browser, the Web Controls generate standard HTML, requiring the browser to perform a round-trip to the server for triggered action events.

Regardless of whether the user's browser is UpLevel or DownLevel, the appropriate code is sent without the user worrying about browsers or browser versions.

To deploy to a web server, you must have administrative access privileges for that computer.

The Web UI can be installed alone or in addition to the Windows UI.

Typically, the Web UI is deployed to a web server and installs files into a virtual directory of the web server; the default virtual directory is GADSNGDEWeb.

If using Oracle 8i/9i, add the ASPNET account to the Oracle home folder. Give the ASPNET account full control. Right-click the Oracle home folder in Windows Explorer, click **Properties**, then click the **Security** tab. Add the ASPNET account and give it full control. You may need to restart the computer.

However, if both user interfaces are installed, they are typically installed to separate folders and quite possibly on separate servers. They can, however, "point" to the same database tables, so all GADS data is stored in the same tables. This feature is possible by using the same GADSNG.xml file for both installations.

Web User Interface Installation Issues

If your Web UI does not seem to work and "looks strange" (refer to Figure 88, where the top menu bar and tabs appear to be missing), it can be due to the Microsoft IE Web Controls either failing to install or not installing in the proper location.

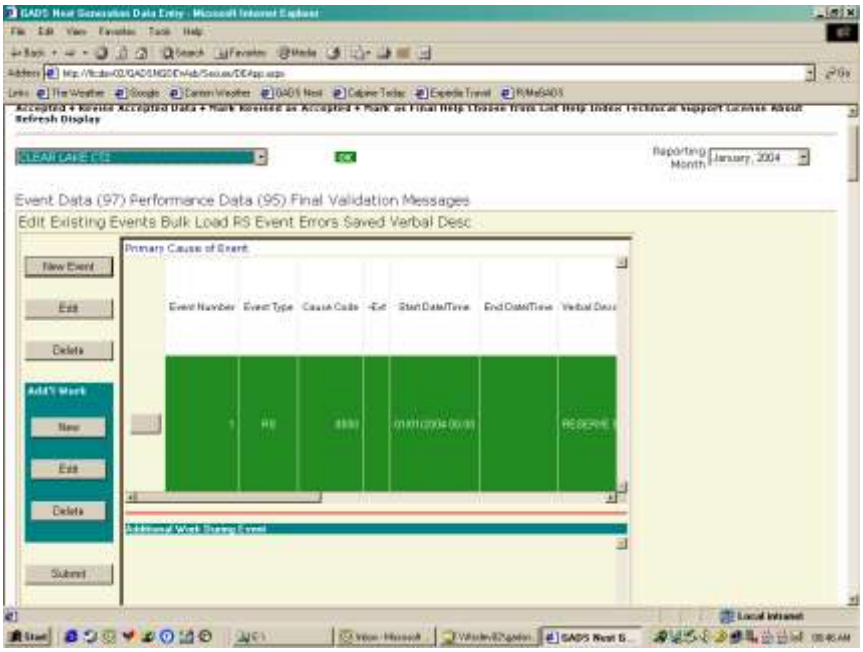

Figure 88. Data Entry Screen with IE Web Controls Not Installed

If the condition above exists, use Windows Explorer to go to the "IE Web Controls" folder on the installation CD and double-click on the Readme.txt file. In the Readme.txt file are the instructions for copying the files in the "IE Web Controls" folder and subfolders to your web site root. This will typically create a folder "C:\Inetpub\wwwroot\webctrl_client," and several levels of subfolders. These files are necessary to control the proper display of the Web UI in Internet Explorer 5.x and above.

Authenticating Web Users/Logging In

In the web root folder is a standard Microsoft .NET file named Web.config that controls how the user accessing the Web UI is authenticated. The default contents of the Web.config file are shown below:

<!-- AUTHENTICATION

This section sets the authentication policies of the application. Possible modes are "Windows", "Forms", "Passport" and "None"

<authentication mode="Forms">

<forms path="/" loginUrl="Secure/DELogin.aspx" name=".GADSNGCookie" protection="All" timeout="30" />

</authentication>

<authentication mode="Windows"></authentication>

-->

<authentication mode="Forms">

<forms path="/" loginUrl="Secure/DELogin.aspx" name=".GADSNGCookie" protection="All" timeout="30" />

</authentication>

The **default mode** is "Forms" authentication that uses a cookie with a default 30 minute timeout. What makes it work and defines how the authentication is performed is the information between the "<authentication mode=…" and the ending "</authentication>" as shown below. What this default setting means is that whether the user is inside or outside the firewall, they must login using a Login form every time. As discussed below, this behavior can be changed by changing the authentication method to "Windows" in the Web.config file.

<authentication mode="Forms">

<forms path="/" loginUrl="Secure/DELogin.aspx" name=".GADSNGCookie" protection="All" timeout="30" />

</authentication>

The top part of the AUTHENTICATION section is "commented out" through the use of the "<!--" and "-->" markers (i.e., everything between these two markers is commented out). In other words, this is commented out:

<!-- AUTHENTICATION

This section sets the authentication policies of the application. Possible modes are "Windows", "Forms", "Passport" and "None"

<authentication mode="Forms">

<forms path="/" loginUrl="Secure/DELogin.aspx" name=".GADSNGCookie" protection="All" timeout="30" />

</authentication>

<authentication mode="Windows"></authentication>

-->

Integrated Windows authentication uses a cryptographic exchange with the user's Internet Explorer Web browser to confirm the identity of the user.

To change the method for user authentication from "Forms" to "Windows", using any standard text editor such Windows WordPad or Notepad simply change:

<authentication mode="Forms">

<forms path="/" loginUrl="Secure/DELogin.aspx" name=".GADSNGCookie" protection="All" timeout="30" />

</authentication>

to

<authentication mode="Windows"></authentication>

making sure that it is also "outside" the commented-out portion of the file as shown below:

<!-- AUTHENTICATION

This section sets the authentication policies of the application. Possible modes are "Windows", "Forms", "Passport" and "None"

<authentication mode="Forms">

<forms path="/" loginUrl="Secure/DELogin.aspx" name=".GADSNGCookie" protection="All" timeout="30" />

</authentication>

<authentication mode="Windows"></authentication>

-->

<authentication mode="Windows"></authentication>

This setting must be consistent with the Authentication Method set on the **Directory Security** tab of IIS for the web root folder and the Secure folder. If you want to use Windows Authentication, it must be set up in IIS for the web root. However, if IIS cannot authenticate the user with Windows Authentication, they will still be able to log in using the Login form.

As a reminder, even if Integrated Windows authentication is checked on the **Authentications Methods** tab in IIS, leaving the authentication mode setting described above set to "Forms" will force everyone to fill in their User ID and Password on a Login screen before they can access the data. However, changing the setting to "Windows" will require only those users who cannot be authenticated by IIS based on their Windows identity to log in using the Login screen.

The "Forms" login timeout can be set to any valid value in minutes; the default value is 30 minutes. If you do not interact with the server-side portion of the application within the 30 minute timeout period, by clicking **Submit** for example, your web session will timeout and you will lose any data changes made since the last submission.

Special IIS 5.x and 6.0 Considerations

By default, in versions of IIS before 6.0, the option to allow IIS to control the password for the Anonymous account is selected when you enable Anonymous authentication for a web site. This functionality is provided through the sub-authentication component, Iissuba.dll.

By default, the ASPNET account has only the read and execute privileges of the Users Group. The GADS Open Source applications need to write to and create new files in the Secure subfolder of the web root. You can grant permissions to the Secure folder by modifying the Access Control Lists (ACLs). You can access the ACLs for a folder by right-clicking the folder in Windows Explorer, selecting **Properties**, and selecting the **Security** tab. It is preferable to modify the ACLs for the Secure folder, rather than to add general privileges to the ASPNET account.

The permissions needed by the GADS Open Source applications are: Read, Write, Execute, and Create; essentially allowing Full Control to the Secure folder.

Also, by default IIS 6.0 does not enable sub-authentication. GADS Open Source's Web UIs can be installed (and are therefore designed) to use Anonymous authentication; as a result, they must run under the LocalSystem identity. You can use sub-authentication to manage passwords for anonymous accounts in IIS 6.0 by meeting the following requirements:

- The worker process must run as LocalSystem. This is required because sub-authentication permits the process that is running under IIS to authenticate without providing a password. By default, all worker process actions are completed in the context of this worker process identity account. However, when a client request is processed, the thread that processes the request uses a token associated with the client (in this case, the Anonymous or IUSR account) for the duration of the request. This is known as impersonation. (LocalSystem is a highly privileged account. When you enable sub-authentication, administering a Web server by using anonymous users is much easier to set up.)
- The sub-authentication component, Iissuba.dll, must be registered.
- The **AnonymousPasswordSync** metabase property must be enabled (that is, set to TRUE).

IIS 6.0 permits you to group applications in application pools. To configure an application to run under the LocalSystem identity:

1. In the IIS Manager (ISM), expand **local computer**, expand **Application Pools**, right-click the application pool you want to configure, and click **Properties**.
2. Click the **Identity** tab
3. Click **Predefined**, and in the list box next to it, click **Local System**
4. Click **OK**

Set the AnonymousPasswordSync metabase property to TRUE:

1. At the command prompt, change to the IIS AdminScripts folder. By default, this folder is located at C:\Inetpub\AdminScripts
2. Type the following command, and then click **Enter**: *Adsutil.vbs set W3svc/AnonymousPasswordSync true*

The above guidelines are based on the Microsoft Knowledge Base Article—332167—IIS 6.0: HOW TO: Configure IIS to Control the Anonymous Password (last reviewed by Microsoft 7/21/2003). Users are responsible for ensuring that all current and/or revised Microsoft instructions and procedures are followed in configuring IIS 6.0 and should consider the above as suggestions for accomplishing the required changes.

Unlocking the Software with Keys.xml

This file MUST be installed in the same folder(s) as the application(s), including the **Unit Setup Console** installation folder if the **Unit Setup Console** was installed to a separate folder.

The Keys.xml file contains the maximum number of generating units permitted under your software license.

This file is generally provided at the time of the initial software license purchase.

If additional generating units are required after the initial purchase, the software license can be upgraded to increase the maximum number of units permitted (MaxUnits).

The contents of a typical Keys.xml file are shown below:

```
<?xml version="1.0" encoding="utf-8"?>
<ApplicationSettings>
  <Section Name="GADSNGKey">
    <Key Name="MyCompany" Value="Bedrock Generating Company" />
    <Key Name="KeyType" Value="LICENSE" />
    <Key Name="MaxUnits" Value="30" />
    <Key Name="MyKey" Value="rbFnl6WLQRqZjpup4NvqDe3Qs//A33Yc" />
  </Section>
</ApplicationSettings>
```

Code Access Security

Today's highly connected computer systems are frequently exposed to code originating from various, possibly unknown sources. Code can be attached to e-mail, contained in documents, or downloaded over the Internet. Unfortunately, many computer users have experienced firsthand the effects of malicious mobile code, including viruses and worms, which can damage or destroy data, and cost time and money.

Most common security mechanisms give rights to users based on their logon credentials (usually a password) and restrict the resources (often directories and files) that the user is allowed to access.

Therefore, there is a need for a widely applicable security mechanism that allows code originating from one computer system to execute with protection on another system, even when there is no trust relationship between the systems.

To help protect computer systems from malicious mobile code, to allow code from unknown origins to run with protection, and to help prevent trusted code from accidentally or intentionally compromising security, the Microsoft .NET Framework provides a security mechanism called **code access security**.

Code access security allows code to be trusted to varying degrees depending on where the code originates and other aspects of the code's identity.

Code access security also enforces the varying levels of trust on code, which minimizes the amount of code that must be fully trusted to run.

All managed code that targets the common language runtime receives the benefits of code access security, even if that code does not make a single code access security call.

When the Microsoft common language runtime (CLR) determines that code has a specific level of trust, the CLR permits the code to access resources that are protected by that level of trust. By default, a .NET Framework application that runs from the Internet does not have the same level of trust as a .NET Framework application that runs from your local computer. An application that runs from your local computer can access resources such as the file system. However, an application

that runs from the Internet or from a local intranet cannot access the file system on your local computer.

In the .NET Framework, code access security controls access to resources by controlling how code runs. When a user runs an application, the CLR assigns the application to one of the following zones:

- **My Computer** – the application code is hosted directly on the user's computer
- **Local Internet** – the application code runs from a "file share" on the user's intranet
- **Internet** – the application code runs from the Internet
- **Trusted Sites** – the application code runs from a Web site that is defined as "Trusted" in Internet Explorer
- **Untrusted Sites** – the application code runs from a Web site that is defined as "Restricted" in Internet Explorer.

You can set the security level for each zone to High, Medium, Medium-Low, or Low.

Trust levels define the resources that the application can access. The zone, together with other security evidence, such as the publisher, the strong name, the Web site, and the URL of the code, determines the permissions that the CLR grants to the code at run time.

An application that is hosted on a network drive can run on your local computer. To run the application, you must grant a level of trust to the assembly that corresponds to the application. The trust level settings range from **None** to **Full Trust**.

To run the application on your local computer, you must grant Full Trust to the GADS Open Source assemblies. You can use the .NET Runtime Security Policy Installer included on the Installation CD to grant Full Trust permission to the GADS Open Source applications.

.NET Runtime Security Policy Installer

When you run any .NET application on your local machine, it is fully trusted by default.

If you run the same application from another machine, .NET checks to see what permissions that application has to run on your machine.

Depending upon the enterprise-wide settings for your company, a .NET application may require permissions that have not been granted. If the application attempts to run and does not have the required permissions, it will fail with an error related to security violations.

That is why we supply our security policy installer on the installation CD. Otherwise, the GADS Open Source Installer would have to be run on each end user machine using either the supplied Setup.exe or .msi file, unless your company prefers to revise the security policy by some other means.

After the Security Policy Installer is run, your .NET configuration runtime security policy for the machine is modified as shown below.

Under the Machine/Code Groups/All_Code, our Installer adds the Code Group **GADSNG_Code** and under it the **GADSNG_Strong_Name** Code Group. (All of our .NET assemblies are given Strong Names.)

The security policy is changed only at the machine level, and grants Full Trust to the GADS Open Source applications.

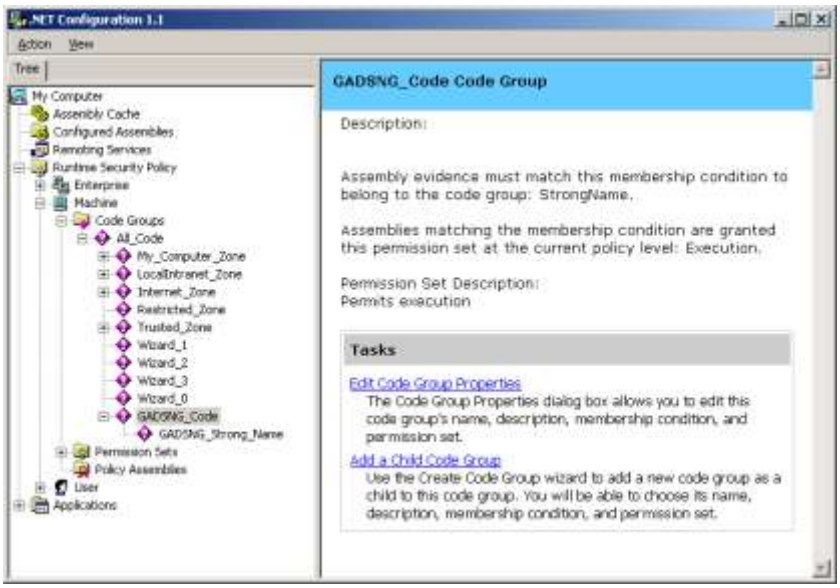

Figure 89. The .NET Configuration 1.1 Wizard

SQL Server 2000 Desktop Engine

Until recently, Microsoft offered two database management options: Microsoft Access and Microsoft SQL Server. With the release of the Microsoft Data Engine (MSDE), an SQL Server-compatible database engine, there is an exciting new option for creating desktop and shared database solutions.

The SQL Server 2000 Desktop Engine (MSDE 2000) is a data engine built and based on core SQL Server technology. With support for single- and dual-processor desktop computers, MSDE 2000 is a reliable storage engine and query processor for desktop or small group applications.

You can install the Microsoft SQL Server 2000 Desktop Engine (MSDE 2000) from the GADS Open Source Data Entry installation CD Installer.

You can then use the SQL Server 2000 Scripts from the installation CD to create the required tables.

However, please be aware that MSDE 2000 is not an "end user" product such as Access, and requires a more sophisticated level of knowledge to use and to support.

Adobe Reader

To install Adobe Reader version 6.0, insert the GADS Open Source CD into your CD-ROM drive. When the Installer displays, click **Close** in the upper right corner of the screen. Open Windows Explorer and browse to the Adobe Reader 6 folder on the GADS Open Source CD. Double-click on AdbeRdr60_enu_full.exe to install the English version of Adobe Reader Version 6.

CD Reading Troubleshooter

While rare, some CD-ROM drives, especially older ones, simply do not read CD-R discs well, or at all. CD-R disc reflectivity spans a broad range specified by CD standards, but some CD-ROM drives were calibrated to read only factory-pressed (silver) discs, which fall within a narrow part of this reflectivity range.

If your CD-ROM drive is unable to read the installation CD, try reading the disc in a different CD-ROM drive, if possible.

If the installation does not start automatically:

1. Click **Start** on the taskbar (**Start** is typically in the lower left corner of the screen) and click **Run**.
2. In the text box next to **Open**, type E:\autorun.hta (where E is the CD drive letter).
3. Click **OK**.

You can also open Windows Explorer and right-click the CD-ROM drive. If the pop-up menu lists **AutoPlay** as an option, clicking **AutoPlay** will run the installation program. If **AutoPlay** is not displayed, you can double-click on the file autorun.hta to manually start the installation process.

Be sure not to leave CD-R discs in a high-temperature location (e.g., in a hot car). Heat damage can make them unreadable.

Some CD-ROM drives may have trouble reading a disc when the lens on the reading laser gets dirty. Check with the manufacturer of the CD-ROM drive about recommended cleaning methods (for example, blowing out dust with a can of compressed air).

Installation Quick Start

The Installer will create up to four desktop shortcuts:

1. **GADSNG Server Console** (if installed)
2. **GADSNG Unit Setup**
3. **GADSNG Admin Console** (if installed)
4. **GADSNG Data Entry** (Windows UI only)

The specific URL will depend upon the actual installation on your web server.

For the Web User Interface you will need to manually set up a **Favorite** in your browser, to an address such as:

http://111.222.1.100/GADSNGDEWeb/MainDE.aspx

MainDE.aspx is the main web page for the Data Entry Web UI.

Initial Startup Issues

Why does it take so long for the application to start the first time after it is initially installed or after we install updates to the software? Every time after that it is fine, but what happens the first time?

The Microsoft .NET Framework 1.1 common language runtime (CLR) provides the infrastructure, enabling managed execution and a variety of services that can be used during execution.

However, before an application can be run, it must be compiled to processor-specific code based on the machine on which it is installed.

Each Data Entry method (or function) for which Microsoft intermediate language (MSIL) has been generated and installed on your machines is just-in-time-compiled (JIT-compiled) when it is called for the first time, and then run.

The next time the Data Entry method is run, the existing JIT-compiled native code is run. The process of JIT-compiling and then executing the code is repeated until execution is complete.

This means that the very first time the application is run after initial installation or updating, it takes a little longer, because the JIT compiler is compiling the code to optimize it for the machine on which it is installed. The next time the application is run it will open normally.

Server Console

Creating a Connection to Your GADS Database

With GADS Next Generation, your GADS data can be stored in Microsoft Access, Microsoft SQL Server 7/2000, or Oracle 8i/9i databases. The **Server Console** allows you to customize the default installation by selecting the location and database type.

The "out-of-the-box" default installation assumes that you are using the Microsoft Access database GADSNG.mdb automatically installed in the same folder as the application. This default installation can be used under a variety of situations, but will be most suited for small GADS data collection groups and for stand-alone installations at individual plant locations.

Use the **Server Console** to:

1. Initially set up the default location in GADSNG.XML for the Microsoft Access database file GADSNG.mdb, or to move GADSNG.mdb to another folder on the same drive or to a network drive (i.e., to change its location)
2. Change the database to either a Microsoft SQL Server 7/2000 or an Oracle 8i/9i database. This requires that you first create the required GADS Open Source tables using the supplied SQL scripts as described in the appropriate sections.

Configuring the Data Connection in GADSNG.xml

We do not recommend that you edit or change this file "by hand" using Notepad, WordPad, or any other text editor, since typing errors could cause the GADS Open Source Data Entry application to fail.

The **Server Console** is responsible for updating the Connection section of the GADSNG.xml file—specifically the **DataSource** and **DBType** values. The GADSNG.xml file must be installed in the same folder as the application. This file tells the Data Entry application where the data is stored and what type of database is being used.

There are default values that allow the application to run in a stand-alone installation on a single user's desktop using Microsoft Access as the database. For more typical installations, the **Server Console** and the **Admin Console** are used to update this file.

The values for the **DataSource** and **DBType** are set using the **Server Console** and the **AdminID** and **AdminPW** values in the Admin Section are set and modified by the **Admin Console**.

Shown below is the default GADSNG.xml file as installed from the Installation CD:

```
<?xml version="1.0" encoding="utf-8"?>
<ApplicationSettings>
  <Section Name="Admin">
    <!--  User application and configured property settings go here.       -->
    <!--  Example: <Key Name="settingName" Value="settingValue"/>-->
    <!--                                                                   -->
    <!--  Initially the AdminID and AdminPW are ""                         -->
    <!--  These need to be set to valid values such as                     -->
    <!--  Example:<Key Name="AdminID" Value="Admin" />                              -->
    <!--              <Key Name="AdminPW" Value="myPassword" />  -->
    <!-- Make sure that "Section", "Name" and "Value" have exactly         -->
    <!--   the mixed case shown with the first letter in caps              -->
    <!--                                                                   -->
    <Key Name="AdminID" Value="" />
    <Key Name="AdminPW" Value="" />
  </Section>
  <Section Name="Connection">
    <Key Name="DataSource" Value="GADSNG.mdb" />
    <Key Name="DBType" Value="OleDb" />
    <!-- DBType can be one of 3 values:  "OleDb", "SqlClient", or "Oracle"  -->
  </Section>
</ApplicationSettings>
```

The **AdminID** and **AdminPW** are described in more detail in the section on the **Admin Console**.

Customizing Microsoft Access

With the GADSNG.mdb Microsoft Access database, you can change the location of the file from the default location (i.e., the folder where the application was installed) to a different folder on the same drive, or to a folder on a network drive.

For the Windows UI installation, the default location is C:\GADS Next Generation Data Entry. However, if you changed the application installation location during the actual installation, you will find the GADSNG.mdb file in the folder you specified for installation.

For the Web-based UI installation, the default location is the path to the folder that contains the contents for the virtual directory.

If you move the GADSNG.mdb file from the default location, open the **Server Console** and change the location as described below:

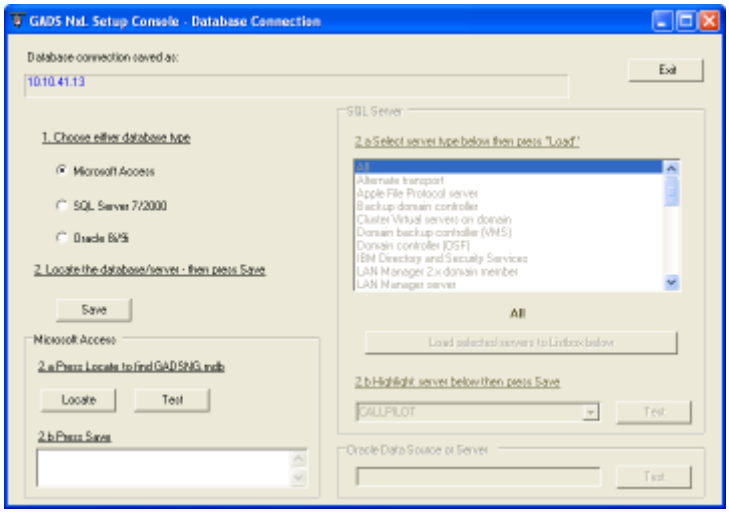

Figure 90. Setup Console

Under 1. Choose either database type ensure that **Microsoft Access** is selected as shown in Figure 90.

*Make sure that you actually click on the GADSNG.mdb file with your mouse so that it shows up and is highlighted in the **File name** box.*

Click **Locate** under 2.a Press Locate to find GADSNG.mdb and the standard Microsoft **File Open** dialog will be displayed. When you have located the correct folder, the GADSNG.mdb file will be displayed in the file/folder list as shown in Figure 91. Highlight (select) the GADSNG.mdb file from the list so that the file name is displayed in the **File name** list box; then click **Open.**

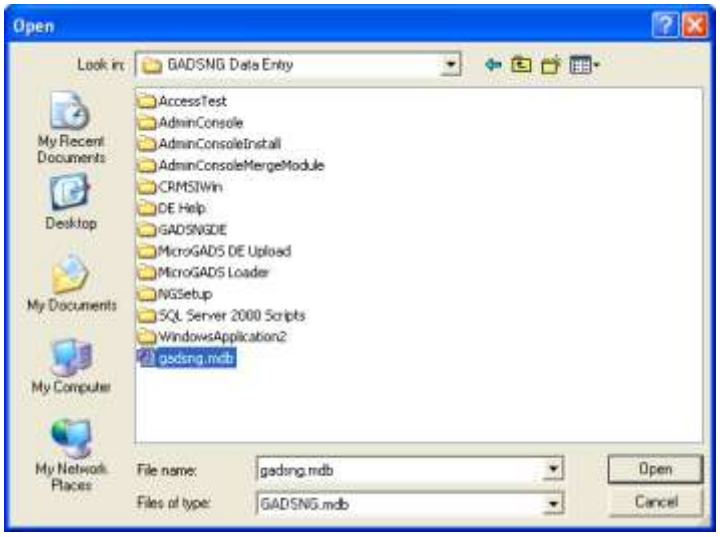

Figure 91. File Open Dialog

The box under 2.b Press Save will now display the new location of the GADSNG.mdb file, as shown in Figure 92.

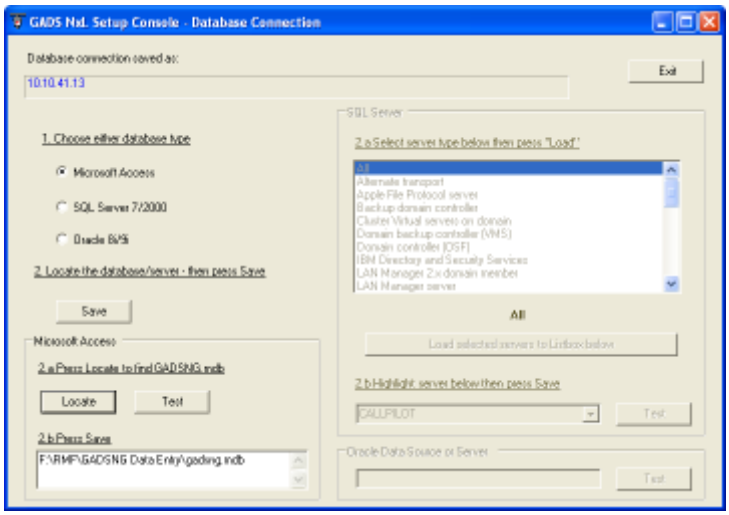

Figure 92. Step 2 – Press Save

Click **Test** to ensure that the **Server Console** can actually connect to the GADSNG.mdb file at the new location.

If the **Console** successfully connects, you will see a dialog box similar to that shown in Figure 93.

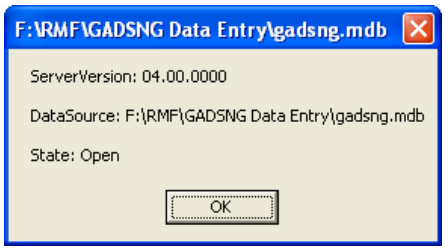

Figure 93. Step 2 – Test Connection

(If the **Console** cannot connect, you will see a dialog box explaining the reason.)

If the **Console** successfully connects with the GADSNG.mdb database, click **Save** under 2. Locate the database/server – then press Save.

At this point you can click **Exit**.

Customizing Microsoft SQL Server

CAUTION – Ensure that the SQL server tables have been created prior to starting this portion of the setup.

Before proceeding with the steps below, create the required GADS Open Source SQL Server 7 or 2000 tables using the supplied SQL scripts.

The scripts are found on the installation CD in the applicable folder.

Under 1. Choose either database type ensure that **SQL Server 7/2000** is selected, as shown Figure 94.

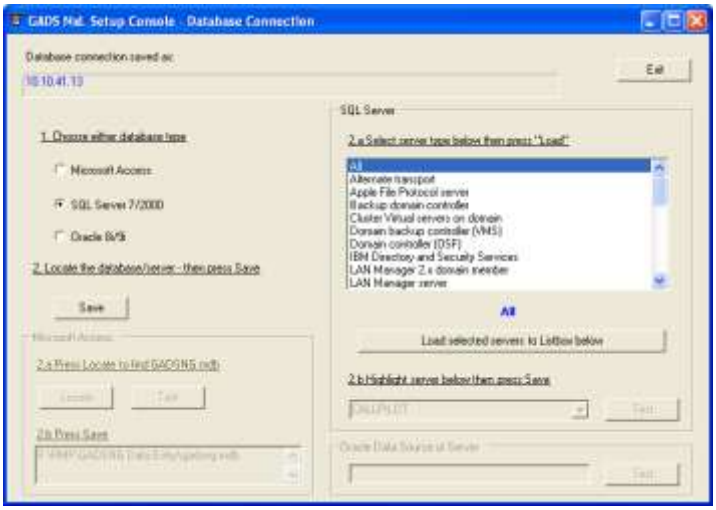

Figure 94. SQL Server 7/2000 Selection

Select the server type from the drop-down list under 2.a Select server type below then press "Load". You can also use the default selection "All."

After selecting the appropriate server type, click **Load selected servers to Listbox below**. The **Console** will search the network connected to the machine where the application is installed (including the machine on which the application is installed) for all servers of the designated type that might be hosting the SQL Server.

If you select a type, and the **Console** is not able to locate any servers of that type, the list box will display **(none)**. At this point, you can select another type or re-select **All,** and click **Load selected servers to Listbox below** again.

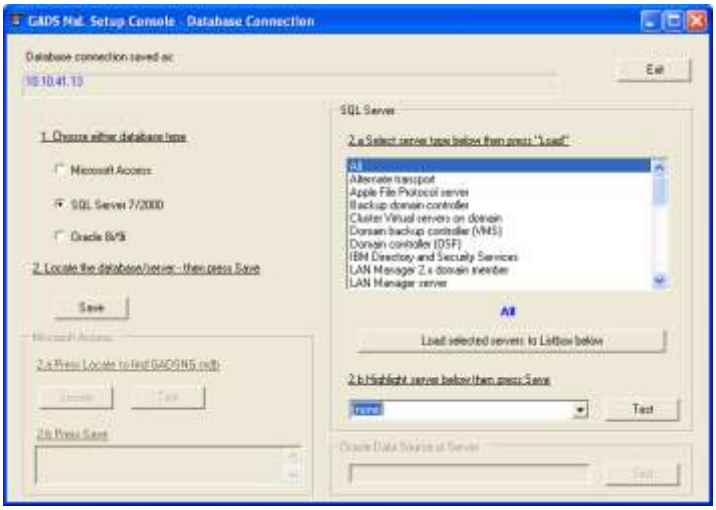

Figure 95. Highlight Selected Server for 2.b

If the **Console** is able to find attached servers, it displays a list of servers in the List box under 2.b Highlight server below and then press Save.

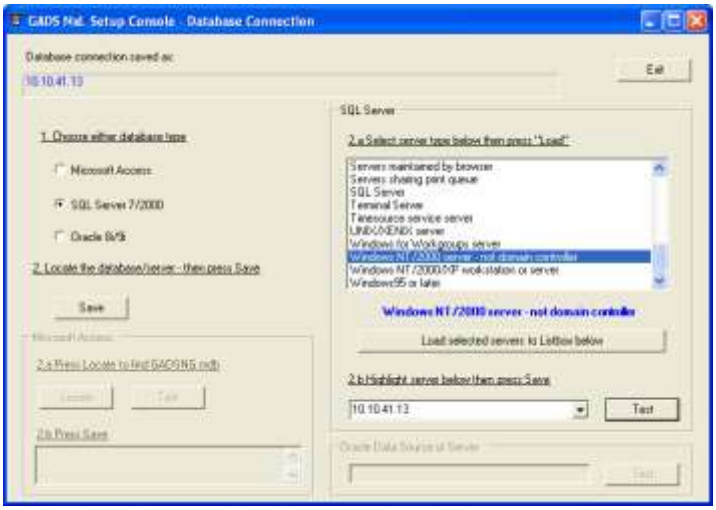

Figure 96. Highlight Selected Server for 2.b Example 1

Using the list box, highlight the server where the SQL server is installed and the GADS Open Source tables have been created.

It is recommended that you test the connection to the appropriate server to ensure that the GADS Open Source SQL Server tables are on the selected server and that the **Console** is able to connect.

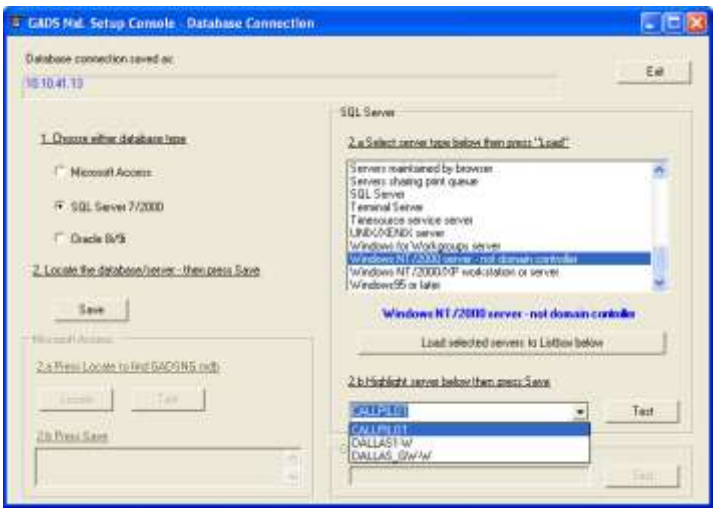

Figure 97. Highlight Selected Server for 2.b Example 2

Click **Test** to ensure that the **Server Console** can actually connect to the SQL Server.

If the **Console** successfully connects, you will see a dialog box similar to those shown in Figure 98 for SQL Server 7 and SQL Server 2000 respectively:

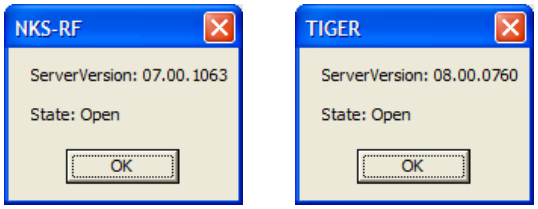

Figure 98. Server Connection Verification Examples

(If the **Console** cannot connect, you will see a dialog box explaining the reason.)

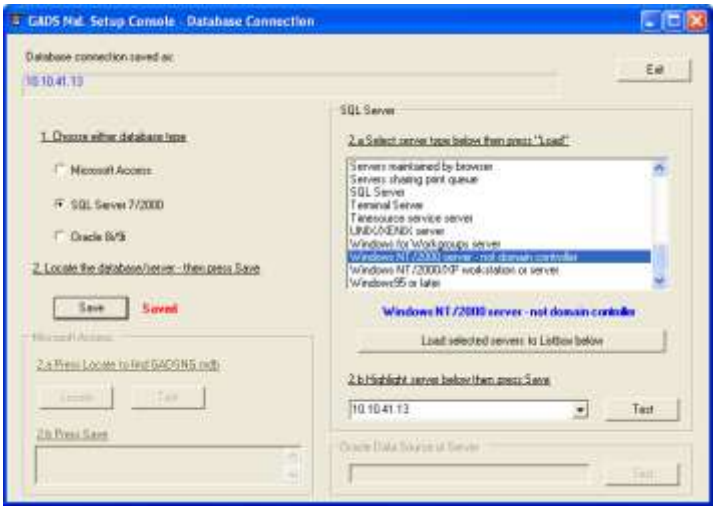

Figure 99. SQL Server 7/2000 Connection Information Saved

If the **Console** connects with the GADS Open Source SQL Server tables, click **Save** under 2. Locate the database/server – then press Save.

At this point, you can click **Exit**.

Customizing Oracle 8i/9i

CAUTION – Ensure that you have created the Oracle tables before starting this portion of the setup.

Before proceeding with the steps below, create the required GADS Open Source Oracle 8i or 9i tables using the supplied SQL scripts.

The scripts are found on the installation CD in the applicable folder.

Under 1. Choose either database type, ensure that **Oracle 8i/9i** is selected, as shown in Figure 100.

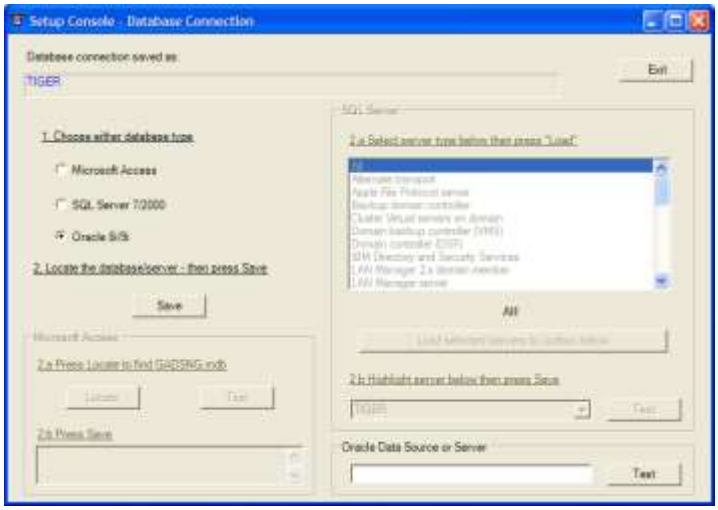

Figure 100. Select Oracle Connection

The screen in Figure 101 shows the Oracle 9i database name as GADSNG.TIGER, with the SID GADSNG on host tiger.

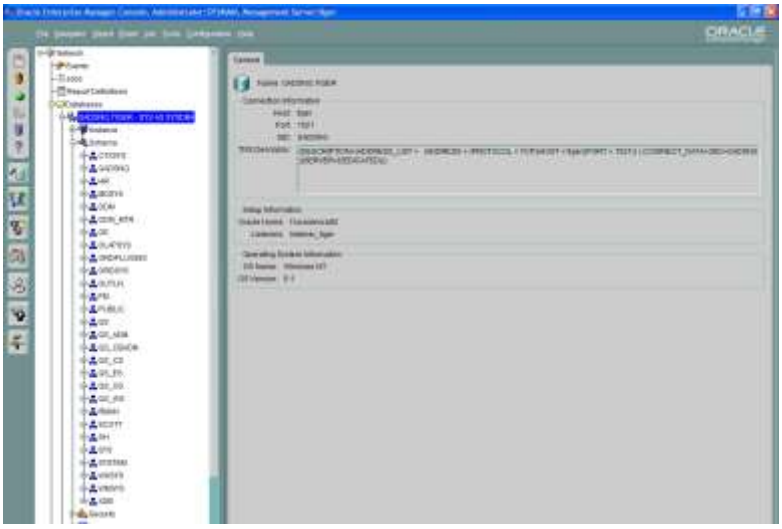

Figure 101. Oracle 9i Enterprise Manager Console

If you know your Oracle 9i data source or server, you may enter it manually by typing it into the text box in the lower right corner of the window, as shown in Figure 102.

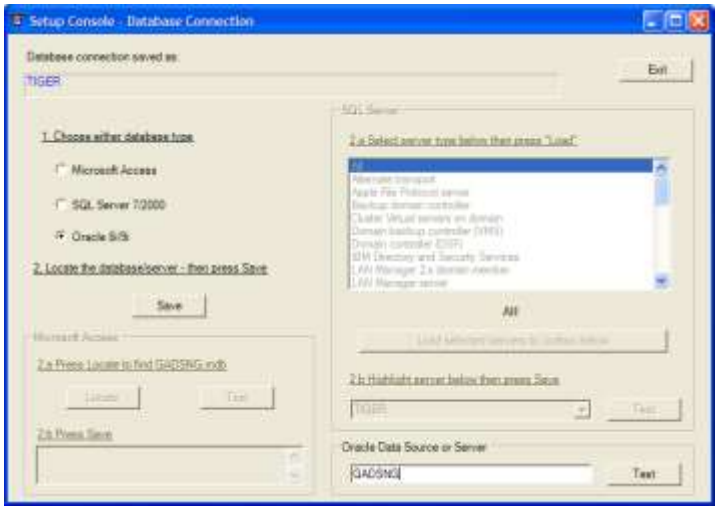

Figure 102. Enter Oracle Data Source or Server Name

Test the connection to the Oracle 9i database. If the test was successful, the **Console** will display the dialog box shown in Figure 103.

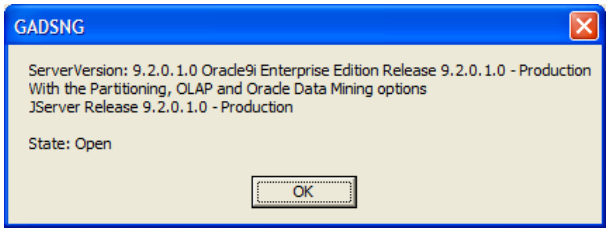

Figure 103. Connection Test Results

The screen in Figure 104 shows the Oracle 8i database name as GADSNG.workgroup, with the SID GADSNG on host workathome.

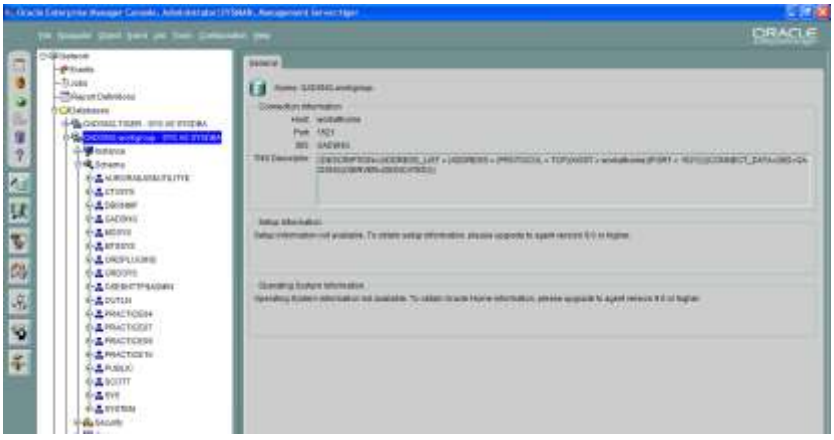

Figure 104. Oracle 8i Enterprise Manager Console

If you know your Oracle 8i data source or server, you may enter it manually by typing it into the text box in the lower right corner of the window, as shown in Figure 105.

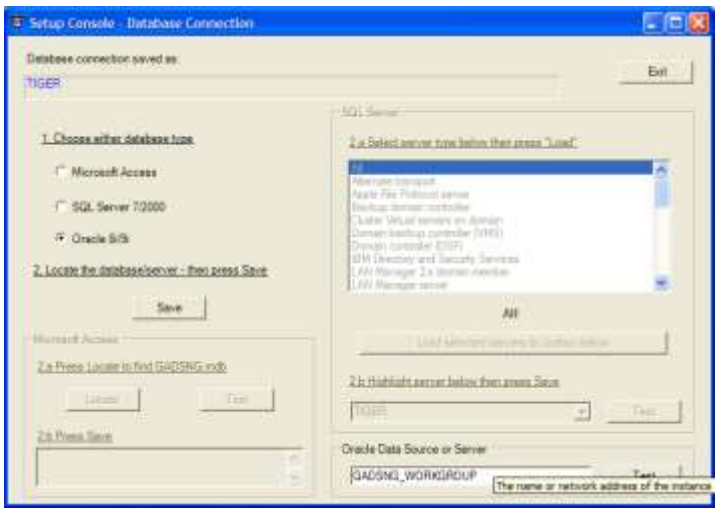

Figure 105. Enter Oracle Data Source or Server Name

Test the connection to the Oracle 8i database. If the test was successful, the **Console** will display the dialog box shown in Figure 106.

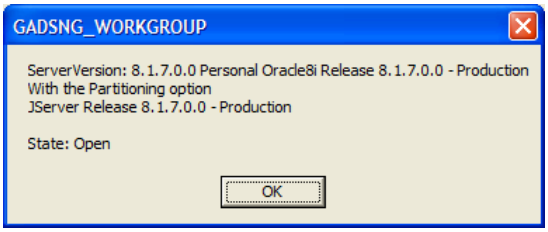

Figure 106. Connection Test Results

If the **Console** is not able to connect, you will see a dialog box explaining the reason.

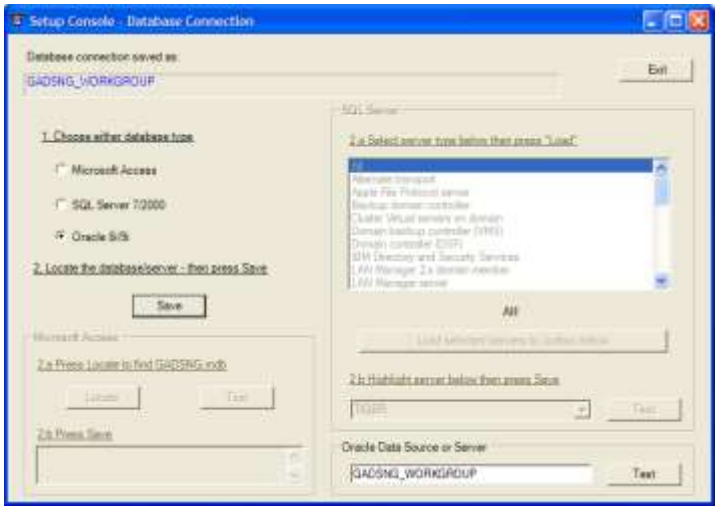

Figure 107. Oracle Connection Information Saved

If the **Console** successfully connects with the GADS Open Source Oracle databases, click **Save** under 2. Locate the database/server – then press Save.

At this point, you can click **Exit**.

Web User Interface *– important note for the Oracle home folder.*

If using Oracle 8i/9i and the Web User Interface, add the ASPNET account to the Oracle home folder. Give the ASPNET account full control. To do this, right-click the Oracle home folder in Windows Explorer. Click **Properties**, then click the **Security** tab. Add the ASPNET account and give it full control. You may need to restart the computer.

SQL Scripts for SQL Server and Oracle

The SQL scripts can be found on the installation CD in the appropriate folder:

- Oracle 8i Scripts
- Oracle 9i Scripts
- SQL Server 2000 Scripts
- SQL Server 7 Scripts

Check out the README.txt file in each folder for installation instructions.

Each folder contains a complete set of initial installation scripts to create and populate the required GADS Open Source tables for the appropriate database system. The README.txt file contains the installation instructions.

Why do we use SQL scripts?

There are several reasons for using SQL scripts. First, most SQL Server and Oracle database administrators (DBAs) are very familiar with SQL scripts and want to review the changes that software vendors propose to ensure that the changes to their databases do not break their existing installations—a very understandable request. ("*What's this vendor going to do to MY database? Crash it?*")

Second, SQL scripts make it possible for us to make future changes to your existing GADS Open Source databases without overwriting all of your historical data. If NERC adds a new GADS data element (such as the Dominant Derating field), scripts allow us to easily "update" your existing database tables to add a new column or field without sending you a replacement "database" or "table," which would wipe out all of your historical GADS data. Also, your DBAs are going to be much happier if they can see what changes we're going to make and, again, this is best done with SQL scripts.

Unit Setup Console

Entering Required Data

*When you start the **Unit Setup Console**, the screen shows the Required Data as well as tabs to select any of the four Option Pages.*

When you initially install the Data Entry application and open the **Unit Setup Console**, you will see that each **Unit Name** consists of **{Available unit nnnn}** where nnnn starts at 0001 and ends at the maximum number of units for which your software is licensed.

To add a generating unit to the list, select the first "open" available unit and highlight it in the **Unit Name** list box. You can then type in the name of the unit to be added such as "My New Unit".

You should notice that the **NERC Unit Code** field has the value of nnnn for the unit being entered and that there is an error indicator (a white ! inside a red circle) next to this field. The error message is that nnnn is an invalid NERC Unit Code.

The error icon serves two purposes: (1) an indication which "available unit" record is being completed and (2) a reminder that you must complete the **NERC Unit Code** field. (The **NERC Unit Code** is a unique identifier assigned to the unit.)

For example, if you fill in the **Unit Name** for "My New Unit," you will see in Figure 108 that the **NERC Unit Code** is **78**—the first available unit—which was expected.

If the user then presses the TAB key, the cursor moves down to the line below "My New Unit" to "{Available unit 0079}" and now the **NERC Unit Code** field shows 79; not 78 as expected. (Refer to Figure 108.) While you can readily correct or change any data records after entry, carefully noting which data record is being entered can save a lot of frustration.

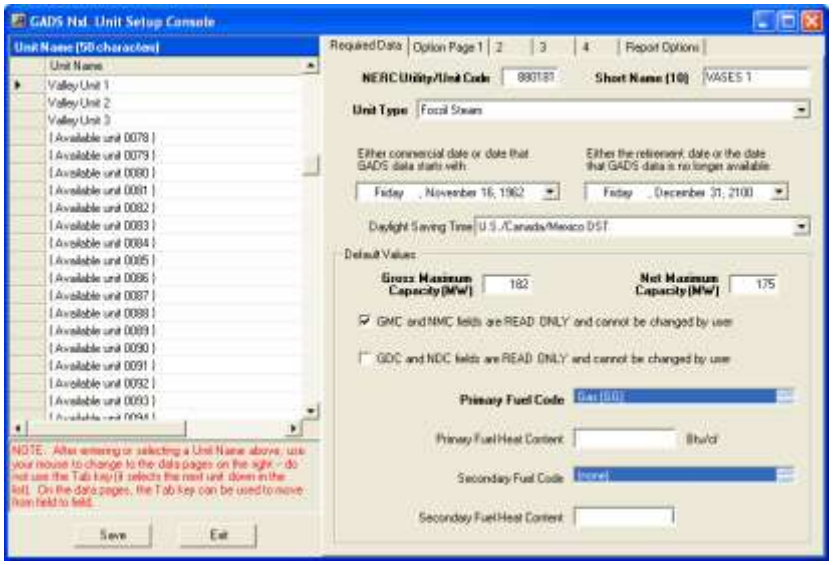

Figure 108. Unit Setup Console

Data Field	Description
Unit Name	Common name for the unit such as Valley Unit 1 (50 characters maximum)
NERC Unit Code	Six-character NERC utility + unit code of the format nAAnAA where n is a numeric digit and A is any alphanumeric character such as 866123.
Short Name	Abbreviated name for reports and data listings (10 characters maximum)
Unit Type	Fossil Steam
(* see definition below)	Fluidized Bed
	Nuclear
	Diesel
	Hydro/Pumped Storage
	Combustion Turbine – Simple Cycle*
	Jet Engine – Simple Cycle*
	Combined Cycle Combustion Turbine*
	Combined Cycle Jet Engine*
	Combined Cycle Steam Cycle*
	Combined Cycle BLOCK with Combustion Turbines*
	Combined Cycle BLOCK with Jet Engines*
	Geothermal
	Misc Multi-Boilers/Multi-Turbines
	Misc – Other
Commercial Date	Either the actual unit commercial date or the date that GADS data starts with
Retirement Date	Either the actual unit retirement date or the date that GADS data is no longer available

Data Field	Description
Daylight Saving Time (DST)	Possible choices: No daylight saving time U.S./Canada England Italy, France, Spain, Germany, and other portions of Europe Romania, Greece, and other portions of Europe Russia Australia Australia and Tasmania New Zealand Tonga
Gross Maximum Capacity (MW)	Default Gross Maximum Capacity Used to fill in the value on the GADS Performance record. (See Maximum Capacity fields Read Only)
Net Maximum Capacity (MW)	Default Net Maximum Capacity Used to fill in the value on the GADS Performance record. (See Maximum Capacity fields Read Only)
GMC and NMC fields are READ ONLY and cannot be changed by user	**When this is checked**, the GADS performance data fields for the Maximum Capacities cannot be input or revised by the user. The values stored in the Setup database table will be copied into the performance data record when it is created. Since the Maximum Capacity fields cannot be changed by the user as the monthly GADS data is being input, the values stored in the Setup table must be updated by this Unit Setup Console or by other external software prior to the creation of the monthly performance data record if the subsequent capacities are to be changed.
GDC and NDC fields are READ ONLY and cannot be changed by user	**When this is checked**, the GADS performance data fields for the Dependable Capacities cannot be input or revised by the user. The values stored in the Setup database table will be copied into the performance data record when it is created. Since the Dependable Capacity fields cannot be changed by the user as the monthly GADS data is being input, the values stored in the Setup table must be updated by other external software prior to the creation of the monthly performance data record if the subsequent capacities are to be changed.
Primary Fuel Code	This is the default Primary Fuel Code. This cannot be changed on the Data Entry input screen.

Data Field	Description
Primary Fuel Heat Content	Default value for the Primary Fuel Heat Content.
Secondary Fuel Code	This is the default Secondary Fuel Code. This can be changed on the Data Entry input screen via a list box.
Secondary Fuel Heat Content	Default value for the Secondary Fuel Heat Content

Unit Type	Definition
Combustion Turbine – Simple Cycle	A combustion turbine operating in a simple cycle as a standalone unit (unit codes 300-399 and 700-799)
Jet Engine – Simple Cycle	A jet engine operating in a simple cycle as a standalone unit (unit codes 300-399 and 700-799)
Combined Cycle Combustion Turbine	A combustion turbine operating as a part of a combined cycle plant (unit codes 300-399 and 700-799)
Combined Cycle Jet Engine	A jet engine operating as a part of a combined cycle plant (unit codes 300-399 and 700-799)
Combined Cycle Steam Cycle	The steam cycle of a combined cycle plant – includes the heat recovery steam generator (unit codes 100-199 and 600-649)
Combined Cycle BLOCK with Combustion Turbines	A combined cycle plant with one or more combustion turbines that is reported as a single BLOCK (unit codes 800-899)
Combined Cycle BLOCK with Jet Engines	A combined cycle plant with one or more jet engines that is reported as a single BLOCK (unit codes 800-899)
Combined Cycle	Similar to a combustion turbine simple cycle, but includes a heat recovery steam generator that extracts heat from the combustion turbine exhaust flow to produce steam. This steam in turn powers a steam turbine engine.
Combined Cycle Plant	An electric generating plant that uses waste heat from its gas turbines to produce steam for conventional steam turbines.

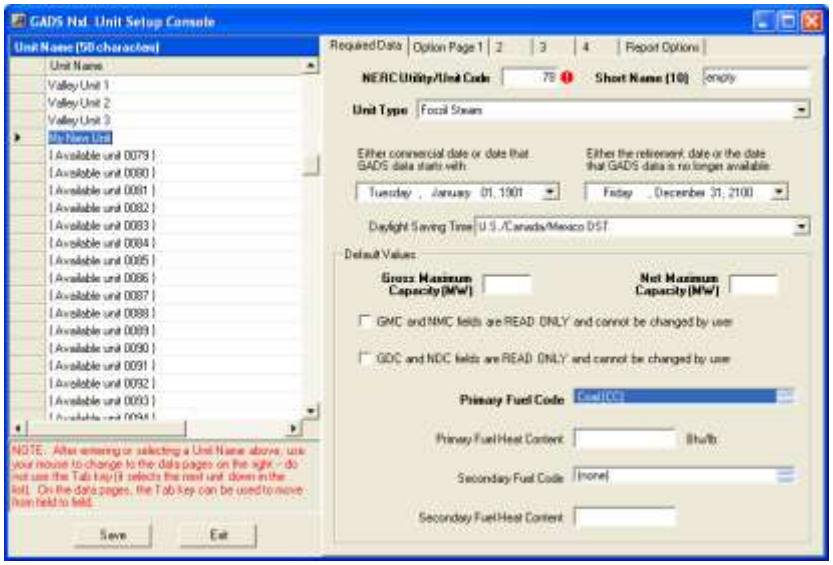

Figure 109. Unit Setup Console Errors Example 1

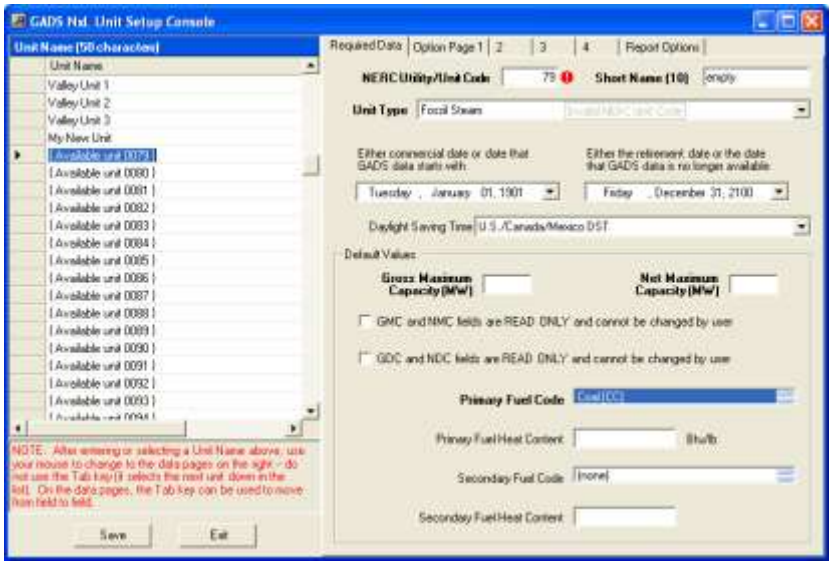

Figure 110. Unit Setup Console Errors Example 2

The four Option Pages allow you to determine what data is reported, the format in which the GADS data is reported, etc., for each generating unit.

The software also defaults to settings that are typical of most installations in the United States, such as English units of measurement for the fuel data instead of SI or metric units.

Unit Identification Code

Each company participating in GADS assigns a unique identification code to each of its units. This 3-digit code allows each unit's data to be uniquely catalogued and filed in the database. This same 3-digit code is also used by the ISOs.

Note that each company must assign identification codes for individual units based on the following criteria:

Unit Type	Coding Series
Fossil (Steam)	100–199
	(Use 600–649 if additional numbers are needed)
Nuclear	200–299
Combustion Turbines (Gas Turbines or Jet Engines)	300–399
	(Use 700–799 if additional numbers are needed)
Diesel Engines	400–499
Hydro/Pumped Storage Units	500–599
	(Use 900–999 if additional numbers are needed)
Fluidized Bed Combustion Units	650–699
Miscellaneous Units (Multi-Boiler/Multi-Turbine, Geothermal, Combined Cycle Block, etc.)	800–899
Combined Cycle – Steam Cycle*	100–199
	(Use 600–649 if additional numbers are needed)

* if the steam cycle is reported separately and not as a combined cycle block.

Option Page 1

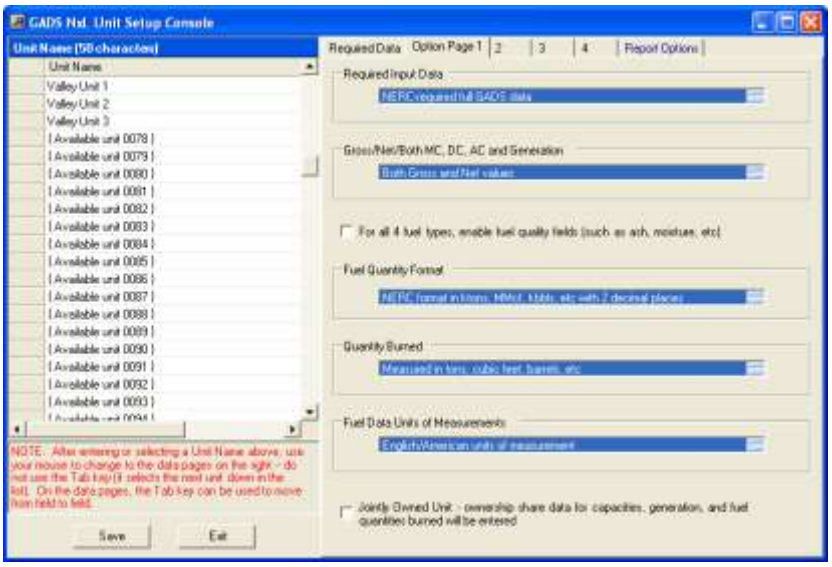

Figure 111. Unit Setup Console Option Page 1

Described below are the Options and the identified default values as appropriate.

Data Fields	Description
Required Input Data (See Note 1 at the bottom of this table)	Choices: NERC full data set NYISO reduced set (refer to Figure 112) Default is the NERC full data set.
Gross/Net/Both MC, DC, AC and Generation	When entering Maximum Capacity, Dependable Capacity, Available Capacity for derating events, and generation data, you can restrict the Data Entry input fields to: Gross data only Net data only (default) Both Gross and Net data
For all 4 fuel types, enable fuel quality fields (such as ash, moisture, etc)	For all four fuel types, when this option is checked, the fuel quality fields are enabled and can be filled in by the user. The fields are enabled by default.
Fuel Quantity Format	Choices: NERC format: fuel quantity burned data is measured in ktons, MMcf, kbbl, etc., with 2 decimal places Full format: fuel quantity burned data is measured in tons, Mcf, bbl, etc. This allows the user to enter fuel quantity burned data in the same format as is typically provided in internal fuel reports. Default is the NERC format

Data Fields	Description
Quantity Burned	Choices: Fuel quantity burned data is in ktons, MMcf, kbbl, etc – consistent with the Fuel Quantity Format selection above. (Default) Fuel quantity burned data is in MMBtu – primarily used for gas-fueled units, but any fuel type can use this measurement selection. The default choice is the same as NERC requires.
Fuel Data Units of Measurement	Choices: Metric (SI) units of measurements English units of measurements Default is English (United States).
Jointly Owned Unit	This is a jointly-owned unit and the **ownership share** of - capacity (GMC/GDC and/or NMC/NDC) - gross and/or net generation (MWh) and - fuels quantity burned data will be entered for this unit. Default is false

Note 1 – Required Input Data option

NYISO does not require that the full NERC GADS data set be submitted to the ISO each month. Figure 112 shows the "minimum" required data.

Because of these requirements, some clients have requested that the Data Entry software not require the full NERC GADS data set to be input. For example, gross maximum capacity, gross dependable capacity, gross actual generation, all fuel data, and the GADS event 02–99 records are NOT required NYISO submissions. Therefore, clients did not want to be required to enter more data than the NYISO requires.

As a result, when the **NYISO-required reduced GADS data** is selected for this option, various input fields and selected validations are disabled to allow the user to enter only the NYISO-required data, and no other data.

The NYISO data set can be created from the full NERC GADS data, but the reverse is not true for creating NERC, PJM and ISO-NE output files when only the NYISO dataset is input.

However, you can still input the full NERC GADS data, and send to NYISO only the required GADS data subset. This is one of the output options with the GADS Open Source Data Entry software. To do this, simply select the **NERC-required full GADS data** choice for the **Required Input Data** option. When you prepare to send the data to NYISO, select NYISO data as the output option. When the NYISO ASCII file is created, it will contain only the NYISO-required output data fields.

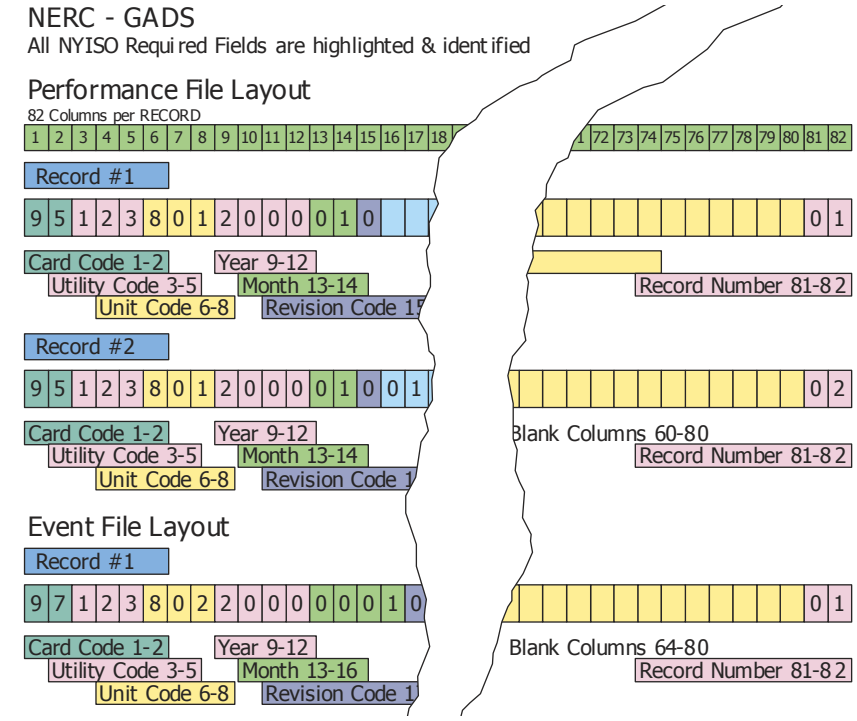

Figure 112. NYISO GADS Data Layout

When the **NYISO-required reduced GADS data** is selected for this option, the options below are reset to the values shown to provide a consistent set of data requirements to allow the user to enter only the data required by the NYISO; and no other data.

Data Fields	Description
Gross/Net/Both MC, DC, AC and Generation	**This option is set to Net data only.**
NERC Event Expanded Reporting will be entered on Option Page 3	**This option is unchecked**
For all 4 fuel types, enable fuel quality fields (such as ash, moisture, etc)	**This option is unchecked**
Performance Record 02 Hours on Option Page 2	**Set to Whole hours (NERC/NYISO format)**
Data Output Options – NERC output on Option Page 2	**This option is unchecked**
Data Output Options – New York ISO output on Option Page 2	**This option is checked**
Data Output Options – PJM output on Option Page 2	**This option is unchecked**
Data Output Options – ISO New England output on Option Page 2	**This option is unchecked**
Enable Work Details fields on Option Page 3	**This option is unchecked**

Option Page 2

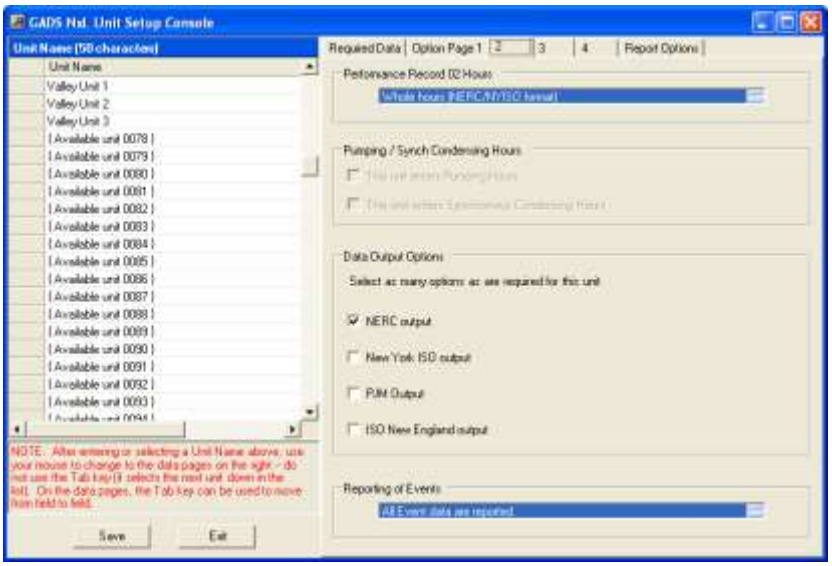

Figure 113. Unit Setup Console Option Page 2

Described below are the Options and the identified default values as appropriate.

Data Fields	Description
Performance Record 02 Hours	Choices: Whole hours (NERC/NYISO format) Hours to 2 decimal places (PJM format) Default is Whole hours.
This unit enters Pumping Hours	Does this unit enter pumping data? If it is a Hydro/Pumped Storage unit type, checking this option enables the Performance 02 record hours data field so that its pumping hours can be input; otherwise, it is disabled Default is checked/enabled.
This unit enters Synchronous Condensing Hours	Does this unit enter synchronous condensing data? If it operates in a synchronous condensing mode and the hours will be reported on the Performance 02 record, checking this option enables the Performance 02 record hours data field so that its synchronous condensing hours can be input; otherwise, it is disabled. Default is checked/enabled for CT/Hydro.

Data Fields	Description
Data Output Options – NERC output	If this option is checked, when the NERC output data files are created, this unit's data is included in the output file.
Data Output Options – NYISO output	If this option is checked, when the NYISO output data files are created, this unit's data is included in the output file.
Data Output Options – PJM output	If this option is checked, when the PJM output data files are created, this unit's data is included in the output file.
Data Output Options – ISO-NE output	If this option is checked, when the ISO-NE output data files are created, this unit's data is included in the output file.
Reporting of Events	Choices: All event data are reported. (Default) All event data EXCEPT Reserve Shutdown events are reported. No Event Data are reported.

Option Page 3

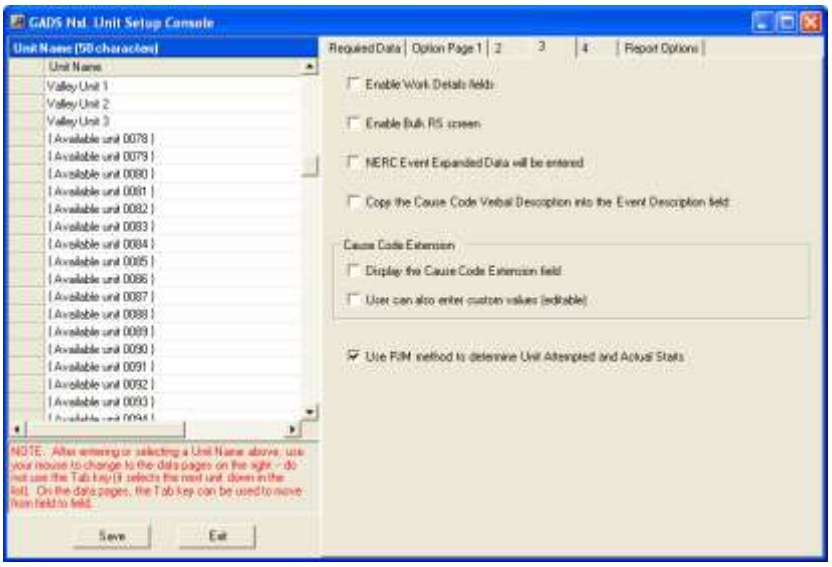

Figure 114. Unit Setup Console Option Page 3

Described below are the Options and the identified default values as appropriate.

Data Fields	Description
Enable Work Details fields	Does this unit report Work Details on the Event records? Default is true (checked).
Enable Bulk RS screen	When entering Reserve Shutdown events, enable bulk RS screen? The software has a special screen that allows generating units that have a large number of RS events to quickly and easily enter only the start of event and end of event dates/times and the software creates the rest of the RS event record. This is primarily a benefit for peaking units that have a large number of RS events per month. Default is false (not checked).

Data Fields	Description
NERC Event Expanded Data will be entered	Will this unit input the NERC expanded data in the event verbal description field columns 50–65? This is primarily aimed at combustion turbine/jet engine units. If you enter the optional Expanded Data Reporting data fields for this unit, check this option. Default is not checked.
Copy the Cause Code Verbal Description into the Event Description field	If you want to enable the software feature to copy the NERC GADS Cause Code Description into the Event Description field, check this option. Default is false (Event Description filled in by hand).
Display the Cause Code Extension field	The 2-character Cause Code Extension field is an optional field. If this option is checked, the software will display the Cause Code Extension combo box with the NERC-defined list of valid cause code extensions. Since this is optional, the default is false.
User can also enter custom values (editable)	The Cause Code Extension is a combo box. This option tells the software whether or not the user can enter free-form text (editable). Default is false.
Use PJM method to determine Unit Attempted and Actual Starts	Even if the unit's data is not reported to PJM, you can have the software determine the Unit Attempted and Actual Starts from the Event data using the PJM methodology. This is done primarily for consistency within a generating fleet consisting of both PJM and non-PJM units.

Option Page 4

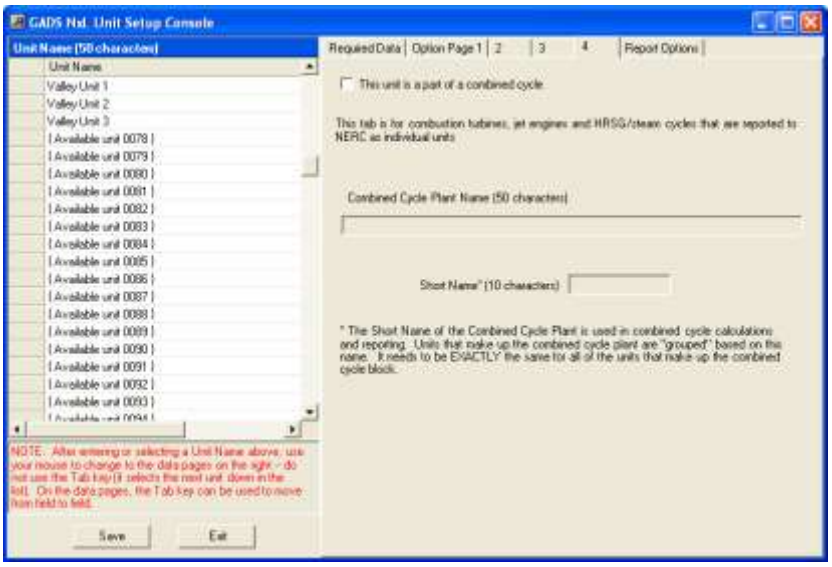

Figure 115. Unit Setup Console Option Page 4

Described below are the Options and the identified default values, as appropriate.

If this unit is part of a combined cycle block, check the option at the top of the page. Checking the option enables the two text boxes described below:

Data Fields	Description
Combined Cycle Plant Name (50 characters)	**Name of the combined cycle plant for doing combined cycle calculations and reports.**
Short Name (10 characters)	**Short name of the combined cycle plant for doing combined cycle calculations and reports.** **Units that make up the combined cycle plant are "grouped" based on this name; it must be exactly the same for all units that make up the combined cycle block.**

Administrative Console

Introduction

Figure 116. Administrative Console

*In this **Admin Console**, you are setting permissions only for the **GADS Open Source Analysis & Reporting** software; not the GADS Open Source Data Entry software.*

The **Admin Console** is used to control or limit access to the GADS data reported in the Analysis & Reporting software, and to limit the functionality available to each user, based on the group(s) to which the specific user is assigned. Using group-based permissions provides the administrators with a simple, straightforward method to control the user's interaction with the software, and creates a control mechanism that is readily adaptable to changing reporting needs.

The most common term used to describe this function is "authorization."

The **Admin Console** also creates global options for the calculations and creates standard text objects for the reports, such as report titles and footers.

Even though the terms are similar, authentication and authorization have two different meanings in the context of software applications.

Authentication is the process of assuring that only allowed persons can access the application and corporate data. This is a security issue. In its broadest sense, it generally means restricting access to applications to company employees; but access can also be restricted to those company employees who have a need to see or use specific company information such as the GADS data and calculated key performance indicators.

This is where authorization comes into play. Authorization defines what authenticated company employees are permitted to do when running the application. This can range from not being able to do anything at all, to full administration rights for GADS coordinators/managers.

The **Admin Console** is used to set the authorization, or "permission," for GADS Analysis users related to accessing GADS data and key performance indicators; not to authenticate the user's right to access the applications themselves.

Generally, it means tiers of responsibility based on groups of units:

- having plant managers, GADS data reporters, and engineers at plant sites who are responsible for using and analyzing calculated GADS data for their own plants
- having possibly mid-level managers and engineering groups responsible for analyzing or oversight of the performance of units and equipment for a portion of the generating fleet (such as a coordinator for the nuclear units)
- having one or more GADS reporters or administrators at headquarters who are responsible for the GADS data and reporting for the entire fleet

The **Admin Console** allows you to define "Groups" and to assign generating units to one or more of these groups. A generating unit can be assigned to as many groups as desired.

For example, you can assign Texas Nuclear Unit 1 and Texas Nuclear Unit 2 to the Texas Nuclear Plant group. If you have more than one nuclear plant site, Texas Nuclear Unit 1 and Texas Nuclear Unit 2 can also be assigned to the Nuclear group. When you perform calculations and generate reports, you can get statistics on the Texas Nuclear Plant group, as well as the Nuclear group, in addition to the statistics on the individual units that make up these two groups.

Create "user" records for the persons who need access to the GADS data and calculated results from the GADS Open Source Analysis & Reporting software, and assign each user to a group.

While you can assign a user to more than one group, we recommend that you create a group to encompass all of the generating units that the user needs to access, rather than assigning the user to multiple groups.

Special Administrator Account

For a master Administrator account, the Group ID No. must be *0* on the **Groups** tab. The **Group Name** can be anything you want—such as *Admin*, *Administrator*, etc.—but it must be assigned a value of *0* for the Group ID No.

The administrator account (Group ID No. = 0) has global full access to all data and can perform all functions in both Data Entry and Analysis & Reporting.

You must also assign all units to this account on the **Assign Units to Groups** tab.

You can create various reporting groups by assigning them a non-zero Group ID No. and giving the group access to all required units.

The intent and purpose of groups defined in Analysis & Reporting is similar and yet much different than in Data Entry. This will be explained further in the Defining Groups section.

The **Admin Console** maintains the data in four database tables:

- ARGroups
- ARUnitPerm
- NGUsers
- ARUserToGroup

The NGUsers table contains the list of valid users and is shared with the Data Entry software; there is only one user list to maintain.

It also utilizes the data stored in the Setup table.

Defining Users

Defining the users who will have access to the GADS data and calculated results is fairly straightforward.

If there are no users defined in the NGUsers table, there are no restrictions or limitations regarding which generating units each user is allowed to access.

Special note for Administrators

As an administrator, you need to make sure that your user information is included in this list, or you will not be able to assign yourself to the Admin group.

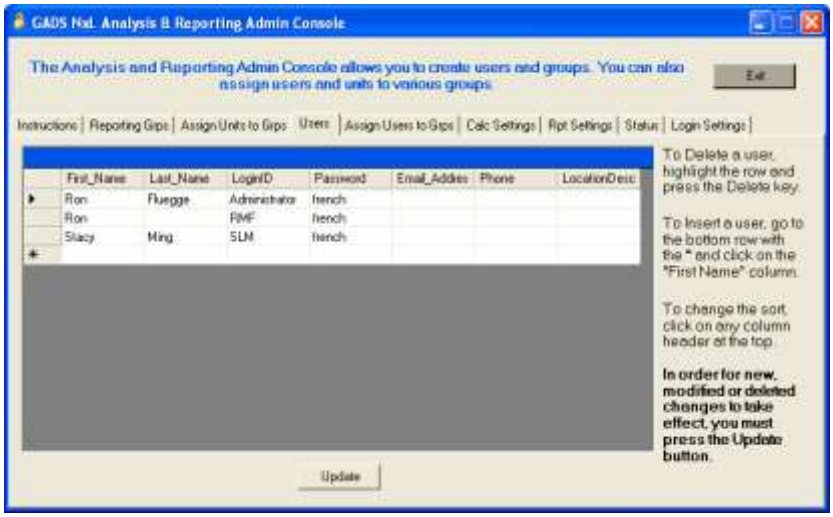

Figure 117. Define Users

The First_Name and Last_Name fields are obvious; however, the programs themselves do not use either of these fields. The fields are there because the company Windows Login IDs may not allow you to readily identify the user by their Login ID.

The Email_Address, Phone, and LocationDesc fields are optional, but useful, providing a handy information source, should you need to contact a particular person.

The intent of the LocationDesc field is to provide a note about the person's office location (e.g., "Bob's desk is in the room next to the maintenance foreman's office"), but it can be used for any notes that you think would be helpful.

Special Note – A Must-Read Section

The Login ID and Password fields require special attention, depending on the type of access the user needs.

FOR THE WINDOWS UI, the Login ID must be the Windows ID that they use to log in to Windows on their machines.

FOR THE WEB UI WITH THE USER INSIDE THE FIREWALL, normally IIS will authenticate the user using the Integrated Windows Authentication and pass the user's ID to the GADS Open Source software. If the user ID sent by IIS matches the Login ID created with the **Admin Console**, the user can perform their authorized functions. The user has been "authenticated" by IIS and the password is not required.

If the user ID sent by IIS does not match any of the Login IDs stored in the GADS Open Source tables, then the user will be required to fill in both the Login ID and Password in a GADS Open Source login web page. If the supplied Login ID and Password match those created with the **Admin Console**, the user can perform their authorized functions.

FOR THE WEB UI WITH THE USER OUTSIDE THE COMPANY'S FIREWALL, the user will be required to fill in both the Login ID and Password in a GADS Open Source login web page. If the supplied Login ID and Password match those created with the **Admin Console**, the user can perform their authorized functions.

Defining Groups

Groups are typically plant sites, unit types at a site (e.g., the CTs at a plant site may be defined as one group, and the steam units at the site as another group, with separate GADS reporters), units of a particular type in the company's fleet (e.g., the nuclear plants may be defines as a separate group), groups based on OEM (e.g., all units with B&W boilers), etc.

When running calculations, the software will generate group statistics as a "rollup" of the calculated data for each unit in the group. If you defined a fossil steam group, the software will calculate the various factors and rates for the "fossil steam group" based on the units that make up this group. You can generate a report and/or extract the fossil steam group data for custom reporting, because its calculated results are stored in the database tables, along with the individual units' results.

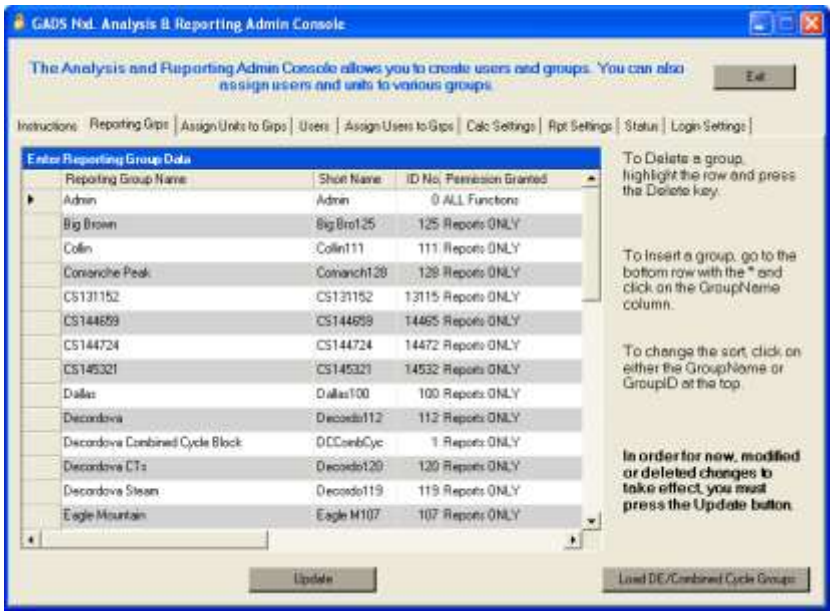

Figure 118. Define Groups

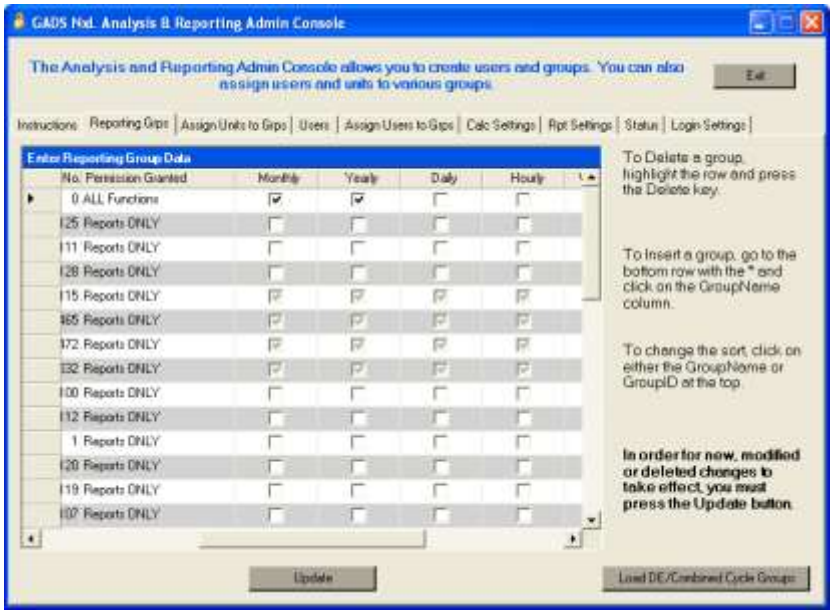

Figure 119. Assign Granularities, Part 1

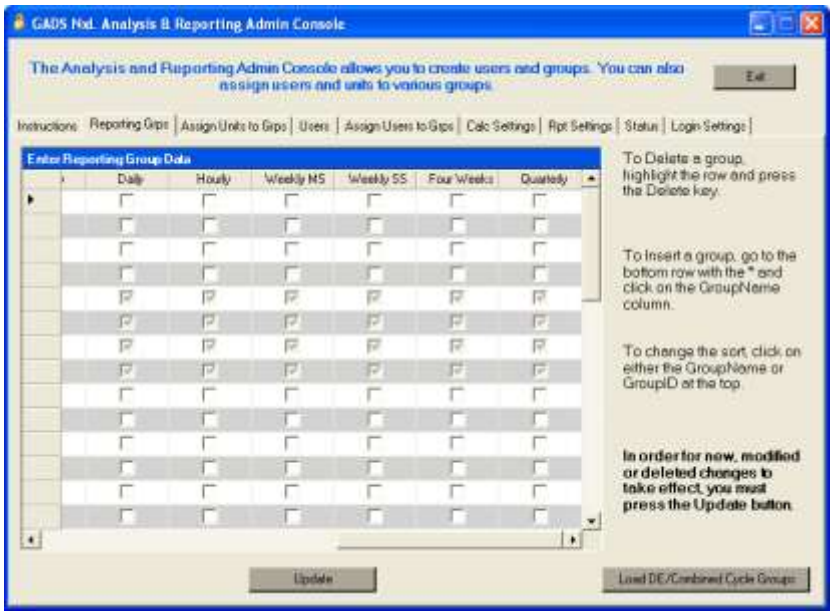

Figure 120. Assign Granularities, Part 2

"Groups" can be any grouping of units, and any given unit can be in more than one group. As an example, a nuclear unit can be in its plant group, as well as your fleet's nuclear group.

Each named group must also have a unique ID No. assigned.

Special Administrator Account/Group

For a master Administrator account, the Group ID No. must be *0* on the **Groups** tab. The **Group Name** can be anything you want—such as *Admin*, *Administrator*, etc.—but it must be assigned a value of *0* for the Group ID No.

The administrator account (Group ID No. = 0) has global full access to all data and can perform all functions in both Data Entry and Analysis & Reporting.

You must also assign all units to this account on the **Assign Units to Groups** tab.

You can create "divisional administrators" or "sub-administrators" by assigning them a non-zero Group ID No. and giving the group access to the required units.

Permission Granted has 4 choices, which can be selected by clicking on the right side of the Permission Granted box for the selected group, using the down arrow to activate the drop-down list, and selecting the permission to be granted to this group.

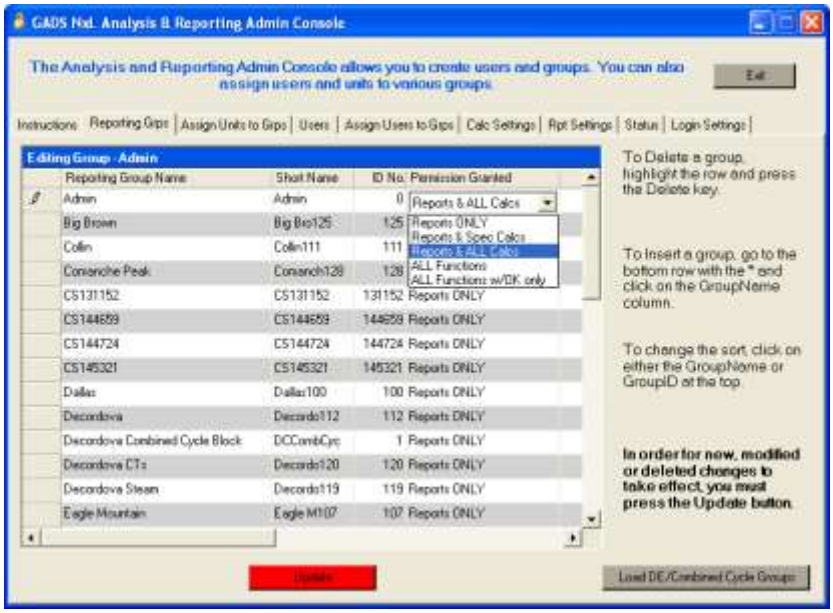

Figure 121. Assign Permissions Granted

These choices determine which tasks the group members are permitted or authorized to perform. If a person is assigned to more than one group, they will be assigned the highest level of authorization allowed by any or all of the groups.

This functionality is tied to the menu items on the main window of the Analysis & Reporting software; depending on the permissions granted, some menu items are disabled and/or not visible, to prevent the user from performing functions they are not authorized to do. The four choices are described as follows:

- **Reports ONLY** – Users can only see the **Generate Reports** command, and can only generate the four report groups, not the **Custom Calculations**. This setting might be used for accounting groups or managers who only need to run the standard reports.
- **Reports & Spec Calcs** – Users can only see the **Generate Reports** command, allowing them to generate the four report groups and perform **Custom Calculations**. This setting might be used for engineers or engineering groups who not only need to run the standard reports, but also need to run special calculations from time to time.

- **Reports & ALL Calcs** – Users can see both the **Create Data Tables** and **Generate Reports** commands, and have the full functionality listed under both menu items. This setting might be used for staff assigned to the group responsible for GADS calculations and report generation. They are not authorized to snapshot the data from the Data Entry tables..
- **ALL Functions** – Users can see all menu items and are fully authorized to perform all Analysis & Reporting functions, including the functions listed under **Load Data**.

The units for which a user is allowed to see/generate reports and the tasks the user can perform are all tied to the group or groups to which they are assigned.

Users assigned to more than one group (such as the administrators) are granted access to units based on the combination of permissions for all assigned groups. They are authorized to perform the functions assigned to the group with the highest level of functionality, rather than restricting the user's ability to do his/her job by assigning the most severe limitations.

The groups must also be assigned the granularities to be calculated during the standard production run (**Create Data Tables** | **Perform Calculations**).

For example, the fleet needs only monthly and yearly statistics, but the nuclear units also need hourly statistics. Therefore, you can assign monthly and yearly granularities to the All Units in Fleet group by checking those two columns on the All Units in Fleet line. On the Nuclear Units group line, you would check the Hourly, Monthly, and Yearly columns. Being in both groups won't cause the nuclear to be run twice. They will, however, be included in the Monthly and Yearly records for both the All Units in Fleet group and the Nuclear Units group. Only the nuclear units individually and the "Nuclear Units" group will have "Hourly" records in the database tables.

Unlike some software applications that only store the monthly statistics or the yearly statistics in their database, GADS Open Source Analysis & Reporting stores all needed statistics in the database tables at the same time. This provides reports more quickly and with less hassle, and makes it easier to create custom reports or data extractions.

You might assume that the calculations take longer since the software is doing all the granularities in one run; however, since the software only calculates the revised or new data, the calculations are amazingly fast, even when calculating all granularities in the same run.

As indicated, the calculations (**Create Data Tables** | **Perform Calculations**) are performed only for units and years with revised or new performance and/or event data. For example, it is 2005, and you are entering and revising GADS event and performance records in GADS Open Source Data Entry for all the units in your fleet. However, this month you also need to update a performance or event record from 2002 for Dallas Unit No. 1. When you Perform Calculations, the software calculates 2004 for all units (in most cases) and Dallas Unit No. 1 for 2002. By incorporating smart processing (Smart Proc™) into the calculation engine, all historical years and units that are not revised are not re-calculated, saving a tremendous amount of time.

Assigning Units to Groups

This tab allows you to assign the generating units to their respective group. The units were created with the **Unit Setup Console**, and the **Admin Console** simply loads the list of units from the Setup table in the database.

Assigning a unit to a group is simply a matter of highlighting the group name in the list on the left and checking the appropriate unit names in the list on the right. Be sure to click **Update** for each group before selecting another group.

A unit can be assigned to more than one group.

Special Administrator Account/Group

Also, you must assign all units to the master administrator account as shown in Figure 122 (simply click **Select ALL**, then **Update**).

You can quickly review the group assignments by highlighting the first group and using the down arrow to scroll through the groups, while watching the check boxes in the unit list on the right.

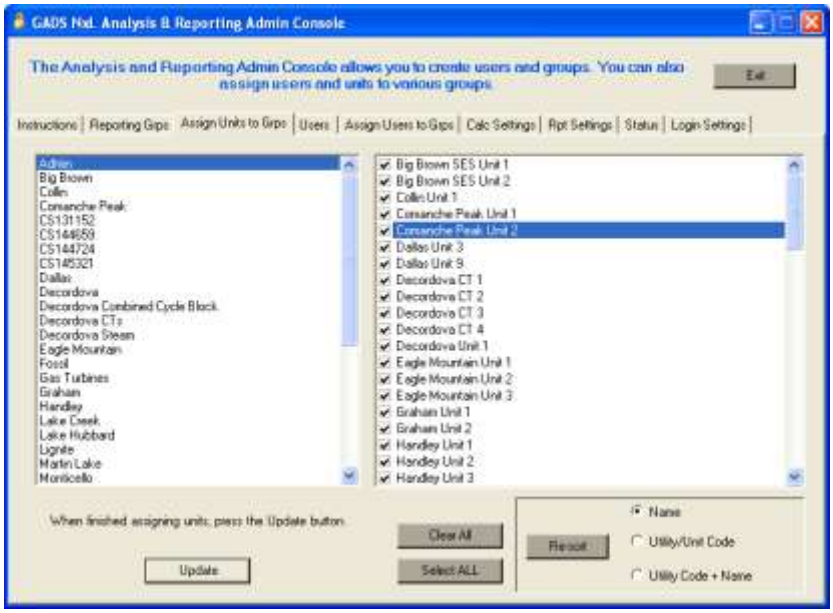

Figure 122. Assign Units to Groups

Assigning Users to Groups

This tab allows you to assign the users to their respective groups—including administrators.

Assigning a user to a group is simply a matter of highlighting the group in the list on the left, and checking the appropriate user names in the list on the right.

Be sure to click **Update** for the group before selecting another group.

You can quickly review the group assignments by highlighting the first group and using the down arrow to scroll through the groups, while watching the check boxes in the user list on the right.

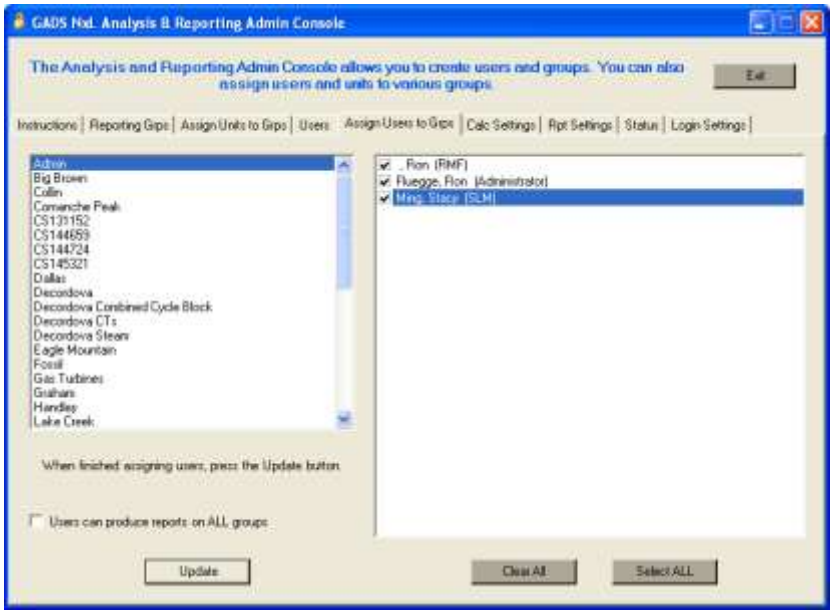

Figure 123. Assign Users to Groups

Calc Settings

The **Calc Settings** tab sets global parameters for calculations and allows you to create the custom cause code groups, which are used during the calculations and as an optional method for selecting data for some reports.

After making new selections or updating the choices, be sure to click **Update** to update the table in the server database.

- **Deratings Calculations** – Generally, companies have a consistent method for reporting maximum, dependable, and available (for deratings) capacities (either gross capacities only, net capacities only, or both). When calculating deratings, the software needs to have a consistent set of the three capacities to perform deratings calculations. Select the option (Gross or Net) for the set of capacities for the software to use to calculate the derating equivalent hours.

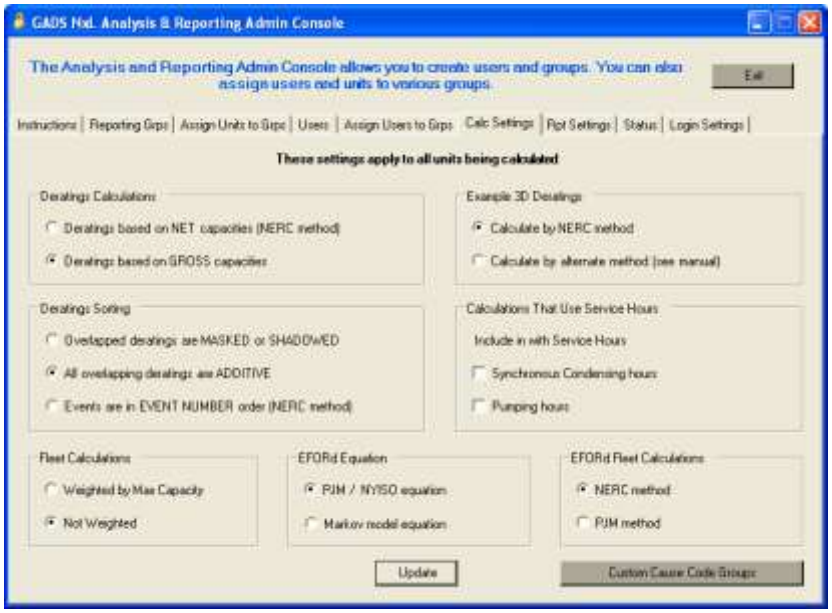

Figure 124. Choose Calculation Settings

- **Deratings Sorting** – When overlapping deratings have the same start of event date/times, the software needs to know how to calculate these deratings. Historically, companies have used one of the following methods as the preferred means to calculate deratings.
    - **Overlapped deratings are MASKED (SHADOWED)** – This method assumes the masking (or shadowing) of all smaller deratings by the largest overlapping derating
    - **All overlapping deratings are ADDITIVE** – This method assumes that all overlapping deratings are additive
    - **Events are in EVENT NUMBER order (NERC method)** – This method assumes that events are in Event Number order (NERC method). NERC processes the data after sorting first by start date, then by event number. This means that when start date/times are identical, the derating with the lower event number is processed first. Therefore, deratings are either shadowed or additive, depending on the event number assigned to the derating and the magnitude of the available capacity.
- **Fleet Calculations** – When units are rolled up into groups, the calculations can be either weighted by the maximum capacity or unweighted. For an unweighted calculation, the smallest unit and the largest unit in the group contribute equally to the group's calculated statistic. For a weighted calculations, a 1000 MW unit's hours are given 10 times the weight of a 100 MW unit's hours, when they are both in the same statistics group.
- **EFORd Equation** – Currently, two equations define how the EFORd is calculated. The only difference is related to the T term and requires that all RS events be reported. The **PJM/ NYISO equation** does not require reporting all RS events, and uses attempted starts in calculating the T term. The **Markov model equation** requires that all RS events be reported, and uses a count of the actual number of RS events reported

in the event data in calculating the T term. Otherwise, for all practical purposes, the two equations are identical.

- **EFORd Fleet Calculations** – The **NERC method** uses the IEEE Standard 762 method for calculating the fleet EFORd by calculating the factors and hours in the numerator and denominator for each unit separately and summing the numerator and denominator terms. The **PJM method** is a Demonstrated Maximum Capacity weighting of the EFORd value; rather than the hours. Both methods are acceptable; it is simply a matter of company preference.
- **Example 3D Deratings** – Refer to the Tips & Tricks section for a detailed explanation of the Example 3D derating method. If you wish to follow the method defined in the NERC Data Reporting Instructions select **Calculate by NERC method**; otherwise select **Calculate by alternate method**.
- **Calculations That Use Service Hours** – Some companies prefer that Pumping Hours and Synchronous Condensing Hours be included in with the Service Hours when calculating the various statistics. If you wish to have either or both included, check the appropriate box. Refer to the Performance Indexes and Equations section to determine which equations include Pumping Hours and Synchronous Condensing Hours in the Service Hours.

On this form, you can also create the custom cause code groups the software uses to fill in the EquipGroupName field in the EventDetails and EventRecords tables, and to filter the data displayed in some of the reports. Clicking on **Custom Cause Code Groups** brings up the following form.

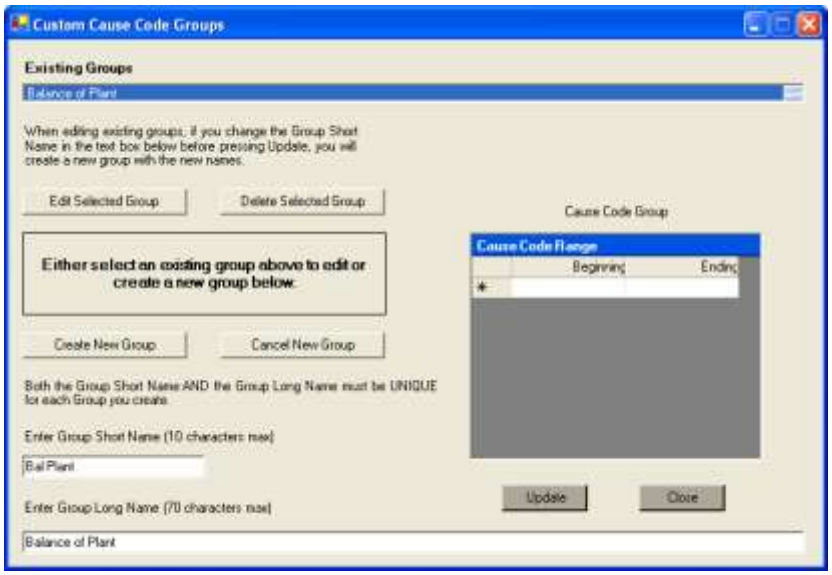

Figure 125. Create Custom Cause Code Groups

The CauseCodeGroups table in the database stores the data for defining the groups. The software is shipped with a standard set of predefined groups, based on the groups identified in the NERC GADS DRI. If the groups provided with the software are appropriate, you don't have to do anything. However, if you wish, you can revise or delete existing groups, or create new ones.

To revise or delete an existing group, highlight the group's name at the top of the form. Click either **Edit Selected Group** or **Delete Selected Group**. If you choose to edit the group, the cause codes defined for the group will be displayed in the data grid on the right side of the form. You can add new ranges or cause codes, you can delete rows in the data grid, and you can revise both the beginning and the ending cause code value as shown in Figure 126.

To create a new group, type a new group name in the **Enter Group Short Name** and **Enter Group Long Name** text boxes and click **Create New Group**. A new, blank data grid will be displayed, allowing you to create the cause code records to define the group.

When you finish editing or creating a new group, be sure to click **Update**. To close the form without updating, click **Close**.

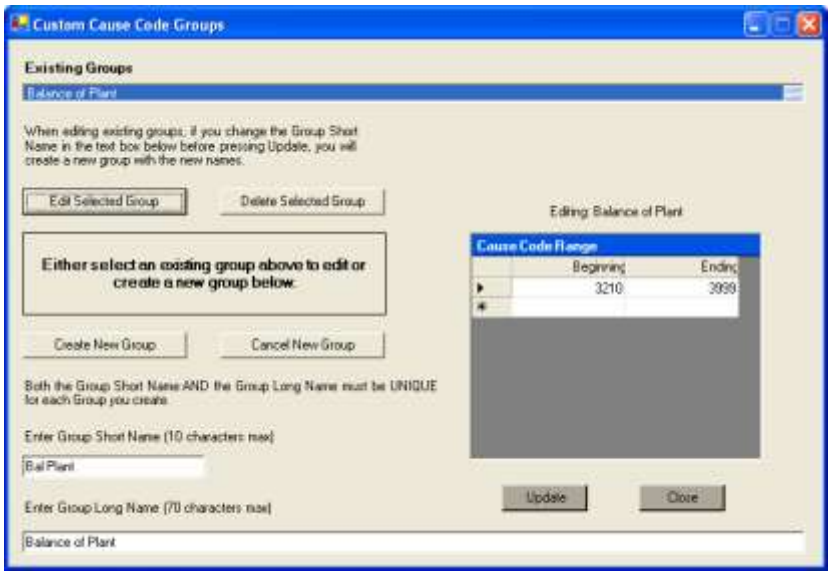

Figure 126. Edit or Delete Custom Cause Code Groups

Rpt Settings

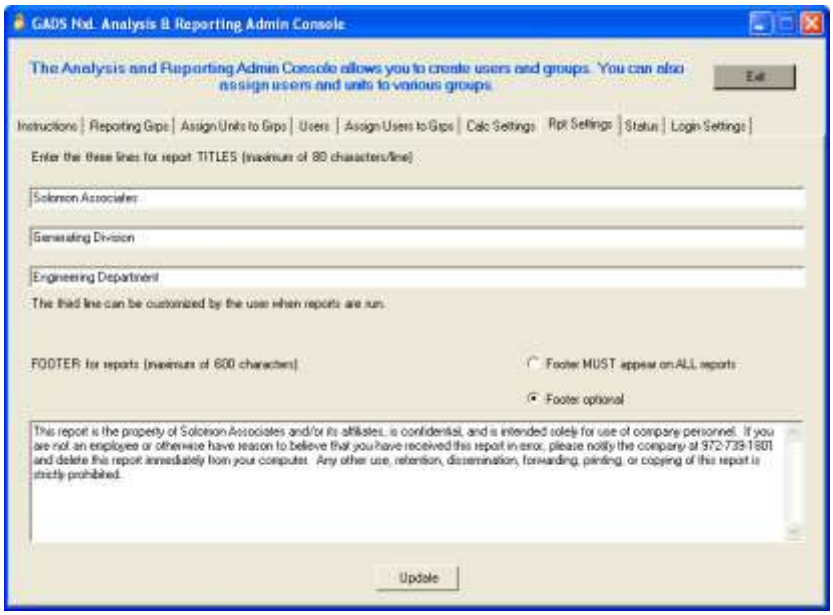

Figure 127. Select Report Settings

The Rpt Settings tab, shown in Figure 127, allows you to enter the three lines that will appear at the top of your reports. This can be anything you want. When you run the reports, you will have an opportunity to customize the third line of the report; however, if you choose not to enter a custom third line, the default text shown above will be displayed.

In addition to the report titles, you can enter the footer text that is displayed at the bottom of each report page. Typically, this is a statement related to the report being company confidential. A default footer is supplied with the software, which will automatically display when opening this form for the first time. The option buttons determine whether the user has an option not to include the footer when the reports are run. This is a policy issue for your company to decide.

Status

On the main form of Analysis and Reporting is an area at the top that is available as a bulletin board to post the status of calculations, or any other information the administrators may want to pass along to the users when they run the program.

Figure 128. Status Area on Main Window

Enter the text to be displayed on the Status tab. Only text can be displayed; no graphics or special characters. A default status is provided when the software is installed and can be changed to suit your needs as often as is necessary.

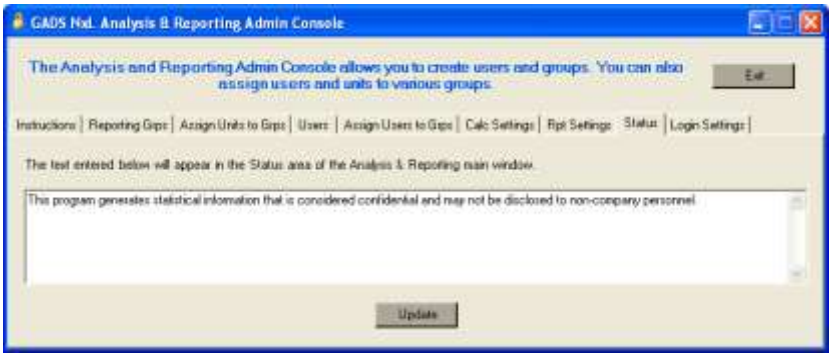

Figure 129. Enter Status Area Text

Login Settings

This tab allows you to set the Administrator's Login ID and Password for permission to run the **Admin Console**.

Initially, the Login ID and Password are blank, to allow you to run the **Admin Console** after a new installation of the software.

Special Note regarding Login ID

It is recommended that you set the Login ID on this tab to be the same as your Windows Login ID, so you can open the **Admin Console** automatically without the login dialog box popping up each time.

After a new installation, the software defaults both the Login ID and the Password to your Windows Login ID. You may change either or both as desired; however, if the Login ID does not match your Windows Login ID, you will be required to log in manually each time.

Figure 130. Administrative Login Settings

Glossary of Terms

% Alkalis

The sum of the average sodium and potassium contents of the fuel, to the nearest 0.1% (by weight), as obtained from an ash analysis.

Because the average heat content (Btu), ash, moisture, sulfur, alkalis, grindability index, vanadium and phosphorus, and softening temperature values may change during a month due to new fuel supplies, etc., these values should be weighted averages.

% Ash

The average ash content of the fuel, to the nearest 0.1% (by weight), obtained from an ultimate analysis of the fuel.

Because the average heat content (Btu), ash, moisture, sulfur, alkalis, grindability index, vanadium and phosphorus, and softening temperature values may change during a month due to new fuel supplies, etc., these values should be weighted averages.

% Moisture

The average moisture content of the fuel, to the nearest 0.1% (by weight), obtained from an ultimate analysis of the fuel.

Because the average heat content (Btu), ash, moisture, sulfur, alkalis, grindability index, vanadium and phosphorus, and softening temperature values may change during a month due to new fuel supplies, etc., these values should be weighted averages.

% Sulfur

The average sulfur content of the fuel, to the nearest 0.1% (by weight), obtained from an ultimate analysis of the fuel.

Because the average heat content (Btu), ash, moisture, sulfur, alkalis, grindability index, vanadium and phosphorus, and softening temperature values may change during a month due to new fuel supplies, etc., these values should be weighted averages.

% Vanadium and Phosphorus (Oil Units Only)

If the fuel type has been identified as oil (OO), kerosene (KE), JP4/5 (JP), or distillate oil (DI), the sum of the average vanadium and phosphorus contents of the fuel, to the nearest 0.1% (by weight), as obtained from an ash analysis.

Because the average heat content (Btu), ash, moisture, sulfur, alkalis, grindability index, vanadium and phosphorus, and softening temperature values may change during a month due to new fuel supplies, etc., these values should be weighted averages.

Actual Unit Starts

Enter the number of times the unit was actually synchronized during the month.

The number of actual unit starts must be less than or equal to the number of attempted unit starts.

AH

Available Hours – The sum of the Unit Service Hours (SH), Reserve Shutdown Hours (RSH), Pumping Hours (PH) if applicable, and Synchronous Condensing Hours (SCH) if applicable.

Ash Softening Temperature

The average ash softening temperature (°F) of the fuel. This temperature should be determined under reducing atmosphere conditions.

Because the average heat content (Btu), ash, moisture, sulfur, alkalis, grindability index, vanadium and phosphorus, and softening temperature values may change during a month due to new fuel supplies, etc., these values should be weighted averages.

Attempted Unit Starts

The number of attempts made to synchronize the unit during the month. Repeated failures to synchronize for the same cause without attempting corrective actions are considered a single attempt.

If startup attempts are abandoned and the unit is shut down for repairs and then started at a future time, report two startup attempts.

Available Capacity

The capacity that is available from the unit, given the restriction imposed by the derating event being reported, after the reduction has been taken into account.

The GAC, the NAC, or both must be completed when the event type is a derating.

Net data is preferred, but gross data must be reported to NERC if it is the only value available. However, PJM and the New York ISO require that Net data be reported.

Data consistency is necessary to calculate availability statistics.

Average Heat Content

The average heat content for the fuel, to the nearest Btu/lb. of coal, Btu/gal. of oil or Btu/cu. ft. of gas. A weighted average if the heat content of the fuel varied.

When reporting data for geothermal units, calculate the heat content using the following equation:

$$\frac{Steam\ Consumption\ (lb) \times 1195.5\ (Btu/lb)}{Net\ Generation\ (kWh)}$$

For nuclear units, this value is the Net Plant Heat Rate (Btu/kWh).

Cause Code Amplification Code

The purpose of the amplification code is to further identify the cause of outage by describing the failure mode. They are alpha-numeric characters place in an unused space following the existing cause code.

Failure modes are leaks, corrosion, personnel error, fire, etc. They are almost identical to the GADS Failure Mechanism Codes except the Cause Code Amplification Code is just two-characters.

Some existing cause codes contain these amplification codes as part of their description.

The Cause Code Amplification Code allows all cause codes to be described with the set of failure modes without increasing the number of cause codes.

It will also allow analysts to further explore the common causes of outages.

Cumulative Engine Starts at Time of Event
(Gas turbine and jet engine units only)

The cumulative number of engine starts experienced by the unit at the time the event began. This data is taken directly from the engine starts counter typically located on the unit's control panel. This counter clocks cumulative engine starts since unit startup.

Cumulative Fired Hours at Time of Event
(Gas turbine and jet engine units only)

The cumulative number of fired hours experienced by the unit at the time the event began.

This data is taken directly from the fired hours meter typically located on the unit's control panel. This meter clocks cumulative operating hours since unit startup.

D1

Unplanned (Forced) Derating – Immediate – A derating that requires an immediate reduction in capacity.

D2

Unplanned (Forced) Derating – Delayed – A derating that does not require an immediate reduction in capacity but requires a reduction within six hours.

D3

Unplanned (Forced) Derating – Postponed – A derating that can be postponed beyond six hours but requires a reduction in capacity before the end of the next weekend.

D4

Maintenance Derating – A derating that can be deferred beyond the end of the next weekend but requires a reduction in capacity before the next Planned Derating (PD).

A D4 can have a flexible start date and may or may not have a predetermined duration.

DE

Derating Extension – An extension of a Planned Derating (PD) or a Maintenance Derating (D4) beyond its estimated completion date.

Use a DE only in instances where the original scope of work requires more time to complete than originally scheduled. Do not use a DE in those instances where unexpected problems or delays outside the scope of work are encountered which render the unit incapable of full load beyond the estimated end date of the PD or D4.

The DE must start at the same time (month/day/hour/minute) that the PD or D4 ended.

Deratings

A derating exists whenever a unit is limited to some power level less than the unit's Net Maximum Capacity. Similar to outages, the general derating event classification is divided into distinct event types, based on IEEE Standard 762.

A derating starts when the unit is not capable of reaching 100% capacity. The available capacity is based on the output of the unit and not on dispatch requirements.

The derating ends when the equipment that caused the derating is returned to service, whether it is used at that time by the operators or not.

More than one derating can occur at one time. It is important to have the events listed in order where the least amount of impact on the unit is listed before the derating with more impact.

All deratings that are greater than 2% of the unit's Net Maximum Capacity and longer than 30 minutes in duration are reported.

Deratings are not caused by ambient-related conditions or system dispatch requirements.

Dominant Derating

All deratings reported to GADS are considered additive unless reported in a more complex manner. When reported in the complex manner, the same events are reported more than once in order to emphasize which derating is the more dominant of the two. It thus creates a problem with the frequency and duration of the derating because the same derating is reported more than once.

The purpose of the Dominant Derating Code is to mark the dominate derating if more than two deratings are occurring at the same time.

By marking the dominate derating, the GADS Next Generation Analysis & Reporting will process the cause code for that dominate derating for its full impact and not hide part of the impact credited to other deratings.

Unit performance statistics will not be affected. Cause code statistics will be more accurate by recording the true frequency and impact of the dominate derating.

The Dominant Derating Code will be identified by a "D".

One example of how two deratings would be reported to GADS – one without the Dominant Derating Code and one with the Dominant Derating Code – is shown in the NERC GADS DRI as Figure III-8.

EFDH

Equivalent Unplanned (Forced) Derated Hours – Each individual Unplanned (Forced) Derating (D1, D2, D3) is transformed into equivalent full outage hour(s).

This is calculated by multiplying the actual duration of the derating (hours) by the size of the reduction (MW) and dividing by the Net Maximum Capacity (NMC). These equivalent hour(s) are then summed.

$$\frac{Derating\ Hours \times Size\ of\ Reduction\ *}{NMC}$$

* Includes Unplanned (Forced) Deratings (D1, D2, D3) during Reserve Shutdowns (RS)

EFDHRS

Equivalent Unplanned (Forced) Derated Hours During Reserve Shutdowns – Each individual Unplanned (Forced) Derating (D1, D2, D3) or the portion of any Unplanned (Forced) derating which occurred during a Reserve Shutdown (RS) is transformed into equivalent full outage hour(s).

This is calculated by multiplying the actual duration of the derating (hours) by the size of the reduction (MW) and dividing by the Net Maximum Capacity (NMC). These equivalent hour(s) are then summed.

$$\frac{Derating\ Hours \times Size\ of\ Reduction}{NMC}$$

EMDH

EMDHRS

Equivalent Maintenance Derated Hours During Reserve Shutdowns – Each individual Maintenance Derating (D4) or the portion of any Maintenance derating which occurred during a Reserve Shutdown (RS) is transformed into equivalent full outage hour(s).

This is calculated by multiplying the actual duration of the derating (hours) by the size of the reduction (MW) and dividing by the Net Maximum Capacity (NMC). These equivalent hour(s) are then summed.

$$\frac{Derating\ Hours \times Size\ of\ Reduction}{NMC}$$

EPDH

Equivalent Planned Derated Hours – Each individual Planned Derating (PD, DE) is transformed into equivalent full outage hour(s).

This is calculated by multiplying the actual duration of the derating (hours) by the size of reduction (MW) and dividing by the Net Maximum Capacity (NMC). These equivalent hour(s) are then summed.

$$\frac{Derating\ Hours \times Size\ of\ Reduction\ *}{NMC}$$

* Includes Planned Deratings (PD) during Reserve Shutdowns (RS)

EPDHRS

Equivalent Planned Derated Hours During Reserve Shutdowns – Each individual Planned Derating (PD) or the portion of any Planned derating which occurred during a Reserve Shutdown (RS) is transformed into equivalent full outage hour(s).

This is calculated by multiplying the actual duration of the derating (hours) by the size of the reduction (MW) and dividing by the Net Maximum Capacity (NMC). These equivalent hour(s) are then summed.

$$\frac{Derating\ Hours \times Size\ of\ Reduction}{NMC}$$

ESEDH

Equivalent Seasonal Derated Hours – ((Net Maximum Capacity (NMC) - Net Dependable Capacity (NDC)) × Available Hours (AH)) / Net Maximum Capacity (NMC)

$$\frac{(NMC - NDC) \times AH}{NMC}$$

EUDH

Equivalent Unplanned Derated Hours – Each individual Unplanned Derating (D1, D2, D3, D4, DE) is transformed into equivalent full outage hour(s).

This is calculated by multiplying the actual duration of the derating (hours) by the size of reduction (MW) and dividing by the Net Maximum Capacity (NMC). These equivalent hour(s) are then summed.

$$\frac{Derating\ Hours \times Size\ of\ Reduction\ *}{NMC}$$

* Includes Unplanned Deratings (D1, D2, D3, D4, DE) during Reserve Shutdowns (RS)

Event Contribution Code

A one-digit code that best describes how the system, major component, or piece of equipment contributed to the event.

Codes	
1	**Primary cause of event** The contribution code 1 must always appear in Section C: Primary Cause of Event. A 1 can only be used on Section D – Additional Cause of Event for a PO or an MO when work on multiple components is scheduled.
2	**Contributed to primary cause of event** Use this code to describe other systems, components, external conditions, or human factors that contributed to cause the event but were not primarily responsible for the event.
3	**Work done during the event** Use this code to identify systems or components that were worked on during the event but did not contribute to the initiation of the event or cause a delay in startup.
5	**After startup, delayed unit from reaching load point**

Event Contribution Codes 2, 3, and 5 can be reported on Section D records, and may be used more than once.

Expanded Data Reporting

Some companies had expressed an interest in reporting more detailed operating and maintenance data to GADS, which would allow them to perform more detailed reliability analyses.

Reporting of this additional information is optional, although strongly encouraged. NERC believes reporting of these data will enhance the usefulness of the GADS database and benefit the entire power industry.

Failure Mechanism Code

The code that best describes the manner in which the component failed.

FOH

Unplanned (Forced) Outage Hours – Sum of all hours experienced during Unplanned (Forced) Outages (U1, U2, U3) and Startup Failures (SF)

Fuel Code

For the Secondary, Tertiary and Quaternary fuels, the two-character code from the list below that identifies the fuels burned in the unit during the reporting period.

Fuel Code	Description
CC	Coal
LI	Lignite
PE	Peat
WD	Wood

OO	Oil
DI	Distillate Oil (No. 2)
KE	Kerosene
JP	JP4 or JP5
WA	Water
GG	Gas
PR	Propane
SL	Sludge Gas
GE	Geothermal
NU	Nuclear
WM	Wind
SO	Solar
WH	Waste Heat
OS	Other Solid (Tons)
OL	Other Liquid (BBL)
OG	Other Gas (Cu. Ft.)

GAC

Gross Available Capacity – The greatest capacity at which the unit can operate during the period of restriction caused by the derating.

If you report Gross Available Capacity (GAC), you must report Gross Maximum Capacity (GMC), Gross Dependable Capacity (GDC), and Gross Actual Generation (GAG) on the Performance Report (95).

GADS

Generating Availability Data System

GADS Cause Codes Outside Plant Management Control
(As of November 4, 2003 – NERC GADS DRI)

Code	Description
3600	Switchyard transformers and associated cooling systems – external
3611	Switchyard circuit breakers – external
3612	Switchyard system protection devices – external
3619	Other switchyard equipment – external
3720	Transmission equipment at the 1st substation (refer to code 9300 if applicable)
3730	Transmission equipment beyond the 1st substation (refer to code 9300 if applicable)
9000	Flood
9010	Fire, not related to a specific component
9020	Lightning
9025	Geomagnetic disturbance
9030	Earthquake
9035	Hurricane
9036	Storms (ice, snow, etc)

9040	Other catastrophe
9130	Lack of fuel (water from rivers or lakes, coal mines, gas lines, etc.) where the operator is not in control of contracts, supply lines, or fuel delivery
9135	Lack of water (hydro)
9150	Labor strikes company-wide problems or strikes outside the company's jurisdiction such as manufacturers (delaying repairs) or transportation (fuel supply) problems.
9300	Transmission system problems other than catastrophes (do not include switchyard problems in this category; refer to codes 3600 to 3629, 3720 to 3730)
9320	Other miscellaneous external problems
9500	Regulatory (nuclear) proceedings and hearings – regulatory agency initiated
9502	Regulatory (nuclear) proceedings and hearings – intervener initiated
9504	Regulatory (environmental) proceedings and hearings – regulatory agency initiated
9506	Regulatory (environmental) proceedings and hearings – intervener initiated
9510	Plant modifications strictly for compliance with new or changed regulatory requirements (scrubbers, cooling towers, etc.)
9590	Miscellaneous regulatory (this code is primarily intended for use with Event Contribution Code 2 to indicate that a regulatory-related factor contributed to the primary cause of the event)

GAG

Gross Actual Generation – The actual number of gross electrical megawatt-hours (MWh) generated by the unit during the month.

If you report both Service Hours and Gross Actual Generation (one to 9999999), GMC or GDC must also be reported. Similarly, if both service hours and a gross capacity value are reported, Gross Actual Generation must also be reported. This provides consistency when calculating performance statistics.

GDC

Gross Dependable Capacity – The gross power level that the unit can sustain during a given period if there are **no equipment, operating, or regulatory restrictions**. By definition, therefore, the GDC is the GMC modified for ambient limitations.

The GDC is the same in intent and purpose as the historically reported Maximum Dependable Capacity (MDC).

GMC

Gross Maximum Capacity – The maximum capacity the unit can sustain over a specified period of time when not restricted by ambient conditions or deratings. To establish this capacity, formal demonstration is generally required. No standard demonstration test method or test duration exists as far as is known at this time, but many of the NERC Regions have their own criteria that all generating companies in that Region follow.

The GMC of a unit should change only as a result of a new performance test or permanent unit modification. GMC is never changed due to equipment problems, even if they persist for a lengthy period of time **unless** the unit is permanently

modified as a result. If the unit is permanently modified, note changes in the unit's design on a new design data form and submit it to NERC GADS for updating.

The various ISOs have their own requirements for establishing the Maximum Capacity values.

Grindability Index (Coal Units Only)

If the fuel type has been identified as coal (CC) or lignite (LI), the weighted average grindability index of the fuel burned during the period.

Because the average heat content (Btu), ash, moisture, sulfur, alkalies, grindability index, vanadium and phosphorus, and softening temperature values may change during a month due to new fuel supplies, etc., these values should be weighted averages.

Hours Worked

The number of hours spent correcting the event cause or making repairs. Include hours expended for on-site repairs, as well as any off-site work.

If the number of hours exceeds four digits, enter *9999* in this field and describe the actual hours expended in the Verbal Description.

If this situation occurs, consider reporting more detailed cause codes, and dividing the hours into the amounts associated with each system or component.

ISO

Independent system operator

ISO-NE

ISO of New England

kWh

kilowatt-hours

MO

Maintenance Outage – An outage that can be deferred beyond the end of the next weekend, but requires that the unit be removed from service, another outage state, or Reserve Shutdown state before the next Planned Outage (PO).

Characteristically, an MO can occur any time during the year, has a flexible start date, may or may not have a predetermined duration, and is usually much shorter than a PO.

MOH

Maintenance Outage Hours – Sum of all hours experienced during Maintenance Outages (MO) and any Scheduled Outage Extensions (SE)

MW

megawatts

MWh

megawatt-hours

NAC

Net Available Capacity – The GAC less any capacity utilized for station service or auxiliary loads.

NAG

Net Actual Generation – NAG is the unit's GAG less any generation (MWh) utilized for that unit's station service or auxiliary loads. If NAG is negative during the month being reported, enter the minus sign in the field with the reported value.

For consistency in calculating statistics, if Net Actual Generation is reported (negative integer or positive integer), NMC or NDC must also be reported. Similarly, if a net capacity value is reported, Net Actual Generation must also be reported.

NC

Noncurtailing Event – An event that exists whenever equipment or a major component is removed from service for maintenance, testing, or other purposes that does not result in a unit outage or derating.

An NC also can exist when a generating unit is operating at less than full capacity due to system dispatch requirements. During this period, equipment can be removed from service for maintenance, testing, or other reasons and be reported as an NC if both of the following conditions are met:

- The available capacity of the unit is not reduced below that required by system dispatch; and,
- Maintenance work can be stopped or completed and the units reach its net dependable capacity (NDC) level within its normal ramp-up time, if and when the unit was needed by the system.

If the conditions cannot be met, report an outage or derating event rather than an NC.

NDC

Net Dependable Capacity – NDC is the unit's GDC less any capacity (MW) utilized for that unit's station service or auxiliary loads.

NERC

National Electric Reliability Council

NERC Format

Requires the use of a decimal place in the fuel data. Data is entered in ktons, kbbl, and MMcf to two decimal places. This option is set in the Unit Setup Console.

Therefore, enter a factor of the actual quantity burned in this field. Use the following factors to determine the correct number to enter:

- 1,000 short tons (2,000 pounds) for coal;
- 1,000 barrels (42 gallons/barrel) for oil; and,
- 1,000,000 cubic feet for gas.

Example:

If coal is your primary fuel and 900 tons of coal was burned in the unit during the reporting period, enter 0.90

If oil is your primary fuel and the unit burned 900,000 barrels of oil, enter 900.00

If gas is your primary fuel and the unit burned 5,090 Mcf (thousands of cubic feet) of gas, enter 5.09

When reporting data for geothermal units, enter in this field the quantity of steam brought into the plant from the geothermal wells. The factor used to determine the number to enter is 1,000,000. Thus, 1,234,500,000 pounds of steam is entered as 1234.50

Leave this field blank when reporting data for nuclear units.

NMC

Net Maximum Capacity – NMC is the unit's GMC less any capacity (MW) utilized for that unit's station service or auxiliary load.

The New York ISO and PJM require Net values only. Gross values are not provided to either when the GADS output files are created for these two ISOs.

NYISO

New York ISO

Optional Full Format

The full value is entered without the NERC decimal. Data is entered in tons, bbls and Mcf as whole integer values. This option is set in the Unit Setup Console.

Example:

If coal is your primary fuel and 900 tons of coal was burned in the unit during the reporting period, enter 900

If oil is your primary fuel and the unit burned 900,000 barrels of oil, enter 900000

If gas is your primary fuel and the unit burned 5,090 Mcf (thousands of cubic feet) of gas, enter 5090

When reporting data for geothermal units, this field is the quantity of steam brought into the plant from the geothermal wells. The factor used to determine the number to enter is 1,000. Thus, 1,234,500,000 pounds of steam is entered as 1234500

This field is blank when reporting data for nuclear units.

Outage

An outage exists whenever a unit is not synchronized to the grid system and not in a Reserve Shutdown state. The general outage event classification is divided into seven distinct event types

An outage starts when the unit is either desynchronized from the grid or when it moves from one unit state to another (for example, goes from a reserve shutdown to a maintenance outage.) The outage ends when the unit is synchronized to the grid or moves to another unit state.

In the case of moving from one unit state to another, the exact date and time that one outage ends will be the same as the next outage starts. The unit state can only be changed if the first outage ends. For example, if the unit is forced off line due to a water wall tube leak (just before it was to come off line for a planned outage), then the forced outage leak repair must be completed before the unit state can be changed from a U1 to a PO. The maintenance crew can start the PO work, but it will not be a PO until the U1 outage work is complete and the unit could be put back in service.

Outside Plant Management Control

IEEE Standard 762 has made a change to examine losses of generation caused by problems with and outside plant management control. The following is quoted from the standard. GADS accepts these guidelines and follows them the best they can in their calculations of unit performance. Following these Guidelines, we have listed those cause codes NERC currently recognizes as being outside plant management control. The following is quoted from the NERC GADS DRI:

"Power Plant Outages Outside of Plant Management Control. There are a number of outage causes that may prevent the energy coming from a power generating plant from reaching the customer. Some causes are due to the plant operation and equipment while others are outside plant management control.

"This Standard sets a perimeter around the power station...It may be assumed that all problems within the power station boundary are within plant management control; however that is not always the case. Therefore, there is a need for some additional clarification as to what is and what is not under plant management control.

"It is easier to identify those actions outside plant management control than to identify the responsibilities of plant management. Therefore, the following are considered to be outside (external) of plant management control. All other items are considered within their jurisdiction and are the responsibility of the plant management for calculating power plant performance and statistics.

"Energy losses due to the following causes should not be considered when computing the unit controllable performance because these losses are not considered to be under the control of plant management:

- "Grid connection or substation failure. This reason relates to problems with transmission lines and switchyard equipment outside the boundaries of the plant as specified by the "boundary of plant responsibility" section (see section 3.4.xxxx – to be assigned) of the Standard.

- "Acts of nature such as ice storms, tornados, winds, lightning, etc are not under plant management control, whether inside or outside the plant boundary.
- "Acts of terrors or transmission operating/repair errors are not under plant management control.
- "Special environmental limitations such as low cooling pond level, or water intake restrictions that could not be prevented by operator action. These are acts of nature such as high ambient temperatures where the equipment is working within design specifications. However, if the equipment is not maintained by the plant such as opacity out of limits or NOx out of control, etc, then plant management should be penalized. These are equipment problems and are within plant management control.
- "Lack of fuels (water from rivers or lakes, coal mines, gas lines, etc) where the operator is not in control of contracts, supply lines, or delivery of fuels.

  "However, if the operator elected to contract for fuels where the fuel (for example, natural gas) can be interrupted so that the fuel suppliers can sell the fuels to others (part of the plant fuel cost-saving measure), then the lack of fuel is under management control and is not applicable to this case.
- "Labor strikes. Outages or load reductions caused by labor strikes are not normally under the direct control of plant management. These strikes may be company-wide problems or strikes outside the company's jurisdiction such as manufacturers (delaying repairs) or transportation (fuel supply) problems.

  "However, direct plant management grievances that result in a walkout or strike are under plant management control and are included as penalties against the plant. If a labor strike is caused by plant management/worker problems during an outage, any outage extensions are included as energy losses as long as the unit is incapable of being restarted because of equipment failures, maintenance, overhauls, or other activities.

  "Other weather related problems such as seasonal variations in gross dependable capacity due to cooling water temperature variations are not within plant management control."

PD

Planned Derating – A derating scheduled well in advance and of a predetermined duration.

Do not report periodic deratings for tests—such as weekly turbine valve tests—as PDs. Report such deratings as Maintenance Deratings (D4).

PH

Period Hours – The number of hours in the month being reported that the unit was in the **active** state. The sum of Available Hours and Unavailable Hours must equal Period Hours.

PJM

Pennsylvania New Jersey Maryland Interconnection LLC

PJM IO Code

This field is enabled if the generating unit is flagged in the **Unit Setup Console** as a PJM-reporting unit.

The only valid IO Codes are *0* and *9*.

A *0* means no IO Code is being submitted. The software will allow either a blank field or *0*. When writing the data out in the PJM format, the software converts a blank IO Code to *0*.

A *9* means an outage (MO, SE, U1–U3) or derating (DE or D1–D4) of a periodic routine nature (e.g., condenser cleaning, deslagging, etc.) which started and ended during a single off-peak period (2200–0800).

The software looks at the Start of Event date/time and the End of Event date/time to determine whether the event qualifies for PJM IO Code 9.

If the event qualifies, by default the software will set the field to a *9*. If you do not want it to be set to *9*, you can manually override the default and reset the field to *0*.

If enter a *9* and the event does not qualify, the software resets the field to *0*.

PJM Special Requirements for Unit Starts

PJM requires that the number of Attempted Unit Starts must be equal to the number of Actual Unit Starts plus the number of Startup Failure events reported in the month. If a unit is flagged as reporting to PJM, then this more restrictive error check is imposed on the unit. NERC does not have this requirement.

PO

Planned Outage – An outage scheduled well in advance and of a predetermined duration. A planned outage lasts for several weeks, and occurs only once or twice a year.

Turbine and boiler overhauls or inspections, testing, and nuclear refueling are typical Planned Outages.

POH

Planned Outage Hours – The total hours the unit was off-line during Planned Outages (PO) and any Scheduled Outage Extensions (SE).

Problem Alert

The problem with the system or component is generic to its design or operation practices.

Because this information may be helpful to others using similar equipment, an "X" alerts the NERC staff to initiate an investigation.

Pumping Hours

Sum of all hours the pumped storage unit is in pumping mode. The units are considered to be in a non-generating service operation.

The number of hours the hydro turbine/generator operated as a pump/motor.

Quantity Burned

The quantity of fuel consumed during the reporting period.

RS

Reserve Shutdown – An event that exists whenever a unit is available for load but is not synchronized due to lack of demand. This type of event is sometimes referred to as an economy outage or economy shutdown. If a unit is shut down due to any equipment-related problems, whether or not the unit was needed by the system, report an Unplanned (Forced) Outage, Maintenance Outage, or Planned Outage, not a Reserve Shutdown.

While a unit is on RS, maintenance work is often performed that would have resulted in a unit outage or derating had the unit been on line. This work can be reported as part of the RS event if, at anytime, the work can be stopped or completed without preventing the unit from:

- synchronizing after a normal startup cycle; and,
- reaching its available capacity after a normal loading cycle.

This criterion remains the same whether or not the unit was needed by the system.

If the above criterion is met, report maintenance work done during the RS on the Event Report (97), Section D (beginning with Record 04), using an Event Contribution Code 3-Other Components Worked During Event.

If maintenance work cannot be stopped or completed the Reserve Shutdown condition of the unit is altered and an outage or derating must be reported.

If the unit cannot be synchronized while the work is being performed, an outage exists and the RS must end.

If the unit cannot attain its available capacity while the work is being performed, a derating exists. The RS event does not end, but report the derating too. Estimate the available capacity as a result of the derating.

RSH

Reserve Shutdown Hours – The sum of all hours the unit was available to the system but not synchronized for economic reasons.

SCH

Synchronous Condensing Hours – The number of hours the unit operated in the synchronous condensing mode (applies primarily to hydro/pumped storage and some combustion turbine units). Do not report these hours as Unit Service Hours.

SE

Scheduled Outage Extensions – GADS defines a scheduled outage extension as an extension of a Planned Outage (PO) or a Maintenance Outage (MO) beyond its estimated completion date. This means that at the start of the PO or MO, the outage had an estimated duration (time period) for the work and a date set for the unit to return to service. All work during the PO and MO is scheduled and all repair times are determined before the outage started.

IEEE Standard 762 states that an extended planned outage is "… the extension of the basic planned outage beyond its predetermined duration." Although the IEEE Standard 762 uses "planned outage", GADS also included maintenance outages as well since they are scheduled and also have a predetermined duration.

The "predetermined duration" of outage also determines the "estimated completion date" of the PO or MO. If the unit is scheduled for four weeks of repairs, then the unit is expected back in service at a certain date four weeks after the start of the outage. In cases where the outage is moved up or back according to the needs of the operating company, ISO or power pool, then the start of the outage plus duration of the outage determines the new completion date. As long as the outage is not longer than planned, the expected completion date is moved to coincide with the predetermined duration period.

If the unit is on outage (for example, U1 outage due to a boiler tube leak) at the time the unit is scheduled to start the PO or MO work, then the work on the cause of the outage (tube repairs) must be completed before changing from the U1 outage to the PO or MO outage. PO and MO work can start but not counted as PO or MO work until the U1 repairs are complete.

All work during PO and MO events are determined in advance and is referred to as the "original scope of work." Use SE only in instances where the original scope of work requires more time to complete than originally scheduled. Where applicable, the extension of the planned or maintenance outage may be required to be approved in advance by your power pool or ISO. Advance warning of an extension is very important and may be an ISO requirement. However, GADS is not dispatch orientated, but is an equipment-orientated database. The reporting of the SE is based on IEEE 762-GADS rules, not ISO requirements. Therefore, if the extension meets the GADS rules, then report it as a SE and not a U1 when reporting to NERC GADS only.

Do not use SE in those instances where unexpected problems or conditions discovered during the outage which render the unit out of service beyond the estimated end date of the PO or MO. Report these delays as Unplanned (Forced) Outage-Immediate (U1). Do not use SE if unexpected problems occur during unit startup. If a unit completes a PO or MO before the original estimated completion date, then any problems causing outages or deratings up until that date are not usually considered to be part of the PO or MO.

SE or U1 must start at the same time (month/day/hour/minute) that the PO or MO ended.

SF

Startup Failure – An outage that results when a unit is unable to synchronize within a specified startup time following an outage or Reserve Shutdown.

The startup period for each unit is determined by the operating company. It is unique for each unit, and depends on the condition of the unit at the time of startup (hot, cold, standby, etc.). A startup period begins with the command to start and ends when the unit is synchronized. SF begins when the problem preventing the unit from synchronizing occurs. The SF ends when the unit is synchronized, another SF occurs, or the unit enters another permissible state.

SH

Service Hours – Sum of all Unit Service Hours

Size of Reduction

Size of Reduction is determined by subtracting the Available Capacity (NAC/GAC) from the Dependable Capacity (NDC/GDC). In cases of multiple deratings, the Size of Reduction of each derating will be determined by the difference in the Net/Gross Available Capacity of the unit prior to the derating and the reported Net/Gross Available Capacity as a result of the derating.

SOH

Scheduled Outage Hours – Sum of all hours experienced during Planned Outages (PO), Maintenance Outages (MO), and any Scheduled Outage Extensions (SE)

Synchronous Hours

Sum of all hours the unit is in the synchronous condensing mode. The units are considered to be in a non-generating service operation.

System/Component Cause Code

The 4-digit code that best identifies the system, major component, or piece of equipment you are describing.

Two additional columns (the cause code extension) are provided for organizations using more detailed cause codes in their internal reporting systems.

Time: Work Started

The date (month/day/hour/minute) the system or component became unavailable for service.

This time can be before the start of the event but should not consider time spent during preparatory work before the system or component was physically taken out of service.

Time: Work Ended

The date (month/day/hour/minute) the system or component became available for service.

Although this time is normally before or the same as the end of the event, it can be after according to the NERC validation checks.

Trip Mechanism (manual or automatic)
(Gas turbine and jet engine units only)

The code that describes how the unit was shutdown. Select "A" for automatically (control system initiated), or "M" for manually (operator initiated).

Typical Unit Loading Characteristics

The code from the list below that best describes how the unit was operated or loaded during the month being reported.

Code	Description
1	Base loaded with minor load following at night and on weekends
2	Periodic startups with daily load-following and reduced load nightly
3	Weekly startup with daily load-following and reduced load nightly
4	Daily startup with daily load-following and taken off-line nightly
5	Startup chiefly to meet daily peaks
6	Other

If the unit was off-line during the entire period, describe how the unit typically would have been loaded had it been on-line.

If you enter Code 6 (Other) for the Typical Unit Loading Characteristics, provide a verbal description explaining how the unit was actually operated during the month.

U1

Unplanned (Forced) Outage – Immediate – An outage that requires immediate removal of a unit from service, another outage state, or an RS state. This type of outage usually results from immediate mechanical/electrical/hydraulic control systems trips and operator-initiated trips in response to unit alarms.

U2

Unplanned (Forced) Outage – Delayed – An outage that does not require immediate removal of a unit from the in-service state but requires removal within 6 hours. This type of outage can only occur while the unit is in service.

U3

Unplanned (Forced) Outage – Postponed – An outage that can be postponed beyond 6 hours but requires a unit to be removed from the in-service state before the end of the next weekend. This type of outage can only occur while the unit is in service.

UH

Unavailable Hours – The sum of Planned Outage Hours (PO), Unplanned (Forced) Outage Hours (FOH: U1, U2, U3 + SF), Maintenance Outage Hours (MOH), and Extensions of Scheduled Outages (SE).

Unit Service Hours

The number of hours the unit was synchronized to the system. For units equipped with multiple generators, count only those hours when at least one of the generators was synchronized, regardless of whether one or more generators were actually in service.

UOH

Unplanned Outage Hours – Sum of all hours the unit was off-line due to immediate, delayed, and postponed outages (U1, U2, and U3), Startup Failures (SF), Maintenance Outages (MO), and any Scheduled Outage Extensions (SE).

Verbal Description

This space allows a detailed explanation of the event and the cause(s) identified by the system/component cause code(s).

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